

**US Army Corps
of Engineers**
Louisville District

Solicitation for

**Qualification Training Range
Fort Knox, Kentucky**

28 July 1998

RFP DACA27-98-R-0048

**BOND REQUIRED
WITH BID**

**THIS PROCUREMENT
HAS NO BUSINESS
SIZE RESTRICTIONS**

USACE CONSTRUCTION CONTRACT FORMAT

| DIVISION | SECTION | TITLE |
|---------------------------------|----------------|---|
| | 00010 | Solicitation/Contract Form (1442) Bid Schedule |
| | 00110 | Instruction to Offers |
| | 00115 | Procedures for Submittal of Offers |
| | 00130 | Proposal Evaluation System |
| | 00600 | Representations and Certifications |
| | 00700 | Contract Clauses |
| | 00800 | Special Contract Requirements |
| 01000 | | Division 1, General Requirements |
| 02000 thru 16999 | | Division 2-16, Technical Provisions |

| | | | | |
|--|---|--|--------------------------------|-------------------------|
| SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair) | 1. SOLICITATION NO. DACA27-98-R-0048 | 2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (SFB) <input checked="" type="checkbox"/> NEGOTIATED | 3. DATE ISSUED 28 July 1998 | PAGE OF PAGES 1 of 5 |
| | | | | |

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

| | | |
|---|---|--|
| 4. CONTRACT NO. | 5. REQUISITION/PURCHASE REQUEST NO. W22W9K-8176-3972 | 6. PROJECT NO. |
| 7. ISSUED BY U.S. Army Engineer District, Louisville Corps of Engineers 600 Dr. Martin Luther King, Jr. Place Louisville, Kentucky 40202-2230 | CODE | 8. ADDRESS OFFER TO U.S. Army Engineer District, Louisville Corps of Engineers 600 Dr. Martin Luther King, Jr. Place Louisville, Kentucky 40202-2230 |
| 9. FOR INFORMATION CALL: | A. NAME See Instructions | B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) See Instruction |

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder."

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

QUALIFICATION TRAINING RANGE, FORT KNOX, KENTUCKY

Construction project is to provide a new standard Qualification Training Range at Fort Knox with a total of 28 firing lanes by modernizing the Heins, Lawly, and O'Brien Ranges. Construction will include all roadways, trails, drainage facilities, target emplacements, armor moving targets, stationary infantry targets, foxholes, firing positions, vehicles firing positions, calibration targets, complete power and data communication systems, control towers, and rear area support facilities. Support facilities include parking area, general instruction buildings, headquarters building, range support building, ammunition breakdown buildings, bleacher enclosures, covered mess, bivouac tent pads and latrines.

The estimated cost range of this project is from \$5,000,000 to \$10,000,000.

BID MODIFICATIONS RECEIVED BY FACSIMILE OR TELETYPE WILL NOT BE CONSIDERED.

AWARD IS BEING MADE PURSUANT TO THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM. (THIS PROCUREMENT HAS NO BUSINESS SIZE RESTRICTIONS.)

DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990) FAR 52.211-14: This is a rated order certified for national defense use, and the Contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700), PRIORITY RATING: DO-C2

11. The Contractor shall begin performance within 10 calendar days and complete it within ** calendar days after receiving
☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. (See **Section 00800, Para 4.)

| | |
|---|--------------------------|
| 12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | 12B. CALENDAR DAYS 10 |
|---|--------------------------|

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 2 copies to perform the work required are due at the place specified in Item 8 by **4:00 p.m.** (hour) local time **27 Aug 1998** (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

Page 2 of 5

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)

15. TELEPHONE NO. (Include area code)

DUNS #

16. REMITTANCE ADDRESS (Include only if different than Item 14)

TIN #

CODE

FACILITY CODE

17. The offeror agrees to perform the work at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government within 60 calendar days after the date offers are due. (Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.

AMOUNTS

Bidders shall show his prices on the Bid Schedule of this section.

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each

AMENDMENT NO.

DATE

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN
(4 copies unless otherwise specified) Will be identified in
Delegation letters.ITEM: Sec
Para. 30

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 U.S.C. 2304(c)() ☐ 41 U.S.C. 253(c)()

26. ADMINISTERED BY CODE

U.S. Army Engineer District, Louisville
Corps of Engineers, P.O. Box 59
Louisville, KY 40201-0059

27. PAYMENT WILL BE MADE BY

USACE Finance Ctr. (UFC)
7800 Third Avenue EFT:T
Millington, TN 38054-5005**CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE**

☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration slated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.

☐ 29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN
(Type or print)

31A. NAME OF CONTRACTING OFFICER (Type or print)

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA

31C. AWARD DATE

BY

Computer Generated

STANDARD FORM 1442 BACK (REV. 4-85)

ALL BIDDERS READ THE FOLLOWING INSTRUCTIONS

1. Each bidder shall, upon request of the Contracting Officer, furnish a list of the plant available to the bidder and proposed for use of the work.
2. Bidders are cautioned that drawings may not be reproduced to exact scale. All drawings, whether full size or reduced, should be checked for potential discrepancies, dimensions and scales should be verified and all drawings compared.
3. Bidders are required to acknowledge receipt of all amendments to this solicitation on Standard Form 1442 in the space provided, by completing Blocks 8 and 15 of the Amendment Form (SF 30), by separate letter, or by telegram prior to opening of bids. Failure to acknowledge all amendments may cause rejection of the bid/proposal.

NOTE: The Louisville District Office does not have it's own teletype. The bidder must insure that acknowledgment of any of any amendments by telegram will be physically delivered (telephone delivery is not acceptable) and received by the Government prior to the time set for opening of bids.

NEITHER FACSIMILE NOR TELEGRAPHIC BIDS ARE AUTHORIZED!!

CAUTION TO BIDDERS

**BEFORE SIGNING AND MAILING THIS BID, PLEASE
TAKE NOTE OF THE FOLLOWING, AS FAILURE TO
PERFORM ANY ONE OF THESE ACTIONS MAY CAUSE
YOUR BID TO BE REJECTED.**

1. **AMENDMENTS.** Have you acknowledge receipt of ALL amendments?
If in doubt as to the number of amendments issued, please contact our office.
2. **AMENDED BID PAGES.** If any of the amendments furnished amended
bid pages, the amended bid pages must be used on submitting your bid.
3. **LATE BIDS.** Please refer to the Instructions section contained
in this package.
4. **BID GUARANTEE.** If bid guarantee is required for this project,
sufficient bid guarantee in proper form must be furnished with your bid for
construction projects exceeding \$100,000.
5. **MISTAKE BID.** Have you reviewed your bid prices for possible errors
in calculations or work left out?
6. **FAX MODIFICATIONS OF BIDS.** We do not permit modifications
of bids by fax.

BID SCHEDULE

| CONTINUATION SHEET | | REFERENCE NO. DOCUMENT BEING CONTINUED DACA27-98-R-0048 | | PAGE 5 of 5 | |
|--|---|--|------|----------------|----------|
| NAME OF OFFEROR OR CONTRACTOR | | | | | |
| ITEM NO. | SUPPLIES/SERVICES | QTY | UNIT | UNIT PRICE | AMOUNT |
| 1 | Qualification Training Range, Ft. Knox, KY | 1 | Job | | \$ _____ |
| | BASE BID | | | | \$ _____ |
| | OPTIONS | | | | |
| O1 | Headquarters Building with Intrusion Detection System | 1 | | | \$ _____ |
| O2 | Range Support Building with Intrusion Detection System | 1 | | | \$ _____ |
| O3 | Latrine Shower Building with Potable Water Source and Septic Tank | 1 | | | \$ _____ |
| O4 | Covered Mess | 2 | | | \$ _____ |
| O5 | Parts Storage Building | 1 | | | \$ _____ |
| O6 | Tent Pads with Framed Tent | 10 | | | \$ _____ |
| O7 | Firing Position Turning Pads | 1 | | | \$ _____ |
| | TOTAL BASE BID + OPTIONS | | | | \$ _____ |
| <p>Prices for the options shall be good for 90 days after award of the contract. The project duration shown in Section 00800, para. 1 will not be affected by the exercising of the options.</p> | | | | | |

SECTION 00110

INSTRUCTIONS FOR NEGOTIATED CONTRACTS

28 March 1998

(1)1. Instructions to Offerors--Competitive Acquisition (OCT 1997)
FAR 52.215-1

(a) Definitions. As used in this provision--
Discussions are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal. In writing or written means any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information. Proposal modification is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award. Proposal revision is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations. Time, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals.

(1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages

(i) addressed to: U.S. Army Engineer District, Louisville
600 Dr. Martin Luther King, Jr. Place
Room 821, Attn: Debbie Bruner
Louisville, KY 40202-2230

(ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show--

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Late proposals and revisions.

(i) Any proposal received at the office designated in the solicitation after the exact time specified for receipt of offers will not be considered unless it is received before award is made and--

(A) It was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(B) It was sent by mail (or telegram or facsimile, if authorized) or hand-carried (including delivery by a commercial carrier) if it is determined by the Government that the late receipt was due primarily to Government mishandling after receipt at the Government installation;

(C) It was sent by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term "working days" excludes weekends and U.S. Federal holidays;

(D) It was transmitted through an electronic commerce method authorized by the solicitation and was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(E) There is acceptable evidence to establish that it was received at the activity designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers, and the Contracting Officer determines that accepting the late offer would not unduly delay the procurement; or

(F) It is the only proposal received.

(ii) Any modification or revision of a proposal or response to request for information, including any final proposal revision, is subject to the same conditions as in subparagraphs (c)(3)(i)(A) through (c)(3)(i)(E) of this provision.

(iii) The only acceptable evidence to establish the date of mailing of a late proposal or modification or revision sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the proposal, response to a request for information, or modification or revision shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is

readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, offerors or respondents should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the envelope or wrapper.

(iv) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(v) The only acceptable evidence to establish the date of mailing of a late offer, modification or revision, or withdrawal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c)(3)(iii) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, offerors or respondents should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and the envelope or wrapper.

(vi) Notwithstanding paragraph (c)(3)(i) of this provision, a late modification or revision of an otherwise successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(vii) Proposals may be withdrawn by written notice or telegram (including mailgram) received at any time before award. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision entitled "Facsimile Proposals." Proposals may be withdrawn in person by an offeror or an authorized representative, if the representative's identity is made known and the representative signs a receipt for the proposal before award.

(viii) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Proposals submitted in response to this solicitation shall be in English and in U.S. dollars, unless otherwise permitted by the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall--

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part-- for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with-- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award.

(1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered,

unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) The Government may disclose the following information in postaward debriefings to other offerors:

(i) The overall evaluated cost or price and technical rating of the successful offeror;

(ii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection;

(iii) A summary of the rationale for award; and

(iv) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

28 March 1998

2. PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997) FAR 52.236-28

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any other proposal form.

(b) The proposal form may require Offerors to submit proposals prices for one or more items on various bases, including --

(1) Lump sum price;

(2) Alternate prices;

(3) Units of construction; or

(4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, Offerors should insert the words "no proposal" in the space provided for any item on which no price is submitted.

(d) Alternate proposals will not be considered unless this solicitation authorizes their submission.

28 March 1998

3. BID GUARANTEE (SEP 1996) FAR 52.228-1 (Para. (a) - (e) only).

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The Offeror shall furnish a bid guarantee in the form of a firm commitment, such as a bid bond supplied by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful offerors as soon as practicable after the opening of bids, and (2) to the successful offeror upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the offer guarantee shall be 20 percent of the offer price or \$3,000,000, whichever is less.

(d) If the successful offeror upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the Offeror, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the Offeror is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(f) The Bid Bond penalty may be expressed in terms of a percentage of the bid price or may be expressed in dollars and cents. Bid bonds are not required for projects under \$100,000.

(g) Individual Sureties. See Paragraph 4.3.

4. PERFORMANCE AND PAYMENT BONDS.

4.1 After the prescribed forms are presented to the offeror to whom award is made for signature, a written contract on the form prescribed by the specifications shall be executed and two bonds, each with good and sufficient surety or sureties acceptable to the Government shall be furnished: a Performance Bond (Standard Form 25) and a Payment Bond (Standard Form 25A). The penal sums of such bonds will be as follows:

(a) Performance Bond. The penal sum of the performance bond shall equal one hundred percent (100%) of the contract price.

(b) Payment Bond.

(1) When the contract price is \$1,000,000 or less, the penal sum will be fifty percent (50%) of the contract price.

(2) When the contract price is in excess of \$1,000,000 but not more than \$5,000,000, the penal sum shall be forty percent (40%) of the contract price.

(3) When the contract price is more than \$5,000,000 the penal sum shall be \$2,500,000.

4.2 Any bonds furnished will be furnished by the Contractor to the Government prior to commencement of contract performance.

4.3 Rules for Use of Individual Sureties.

(a) One individual surety is adequate support for a bond, provided the unencumbered value of the assets pledged by that individual surety equal or exceed the amount of the bond. An offeror may submit up to three individual sureties for each bond, in which case the pledged assets when combined must equal or exceed the penal amount of the bond. Each individual surety must accept both joint and several liability to the extent of the penal amount of the bond.

(b) An individual surety may be accepted only if a security interest in acceptable assets is provided to the Government by the individual surety. The security interest shall be furnished with the bond, and may be provided by one or a combination of the following methods:

(1) An escrow account with a federally insured financial institution in the name of the contracting agency.

(2) A lien on real property, subject to restrictions contained herein.

(c) Acceptable assets include:

(1) Cash or certificates of deposit, or other cash equivalents with a federally insured financial institution;

(2) United States Government securities at market value;

(3) Stocks and bonds actively traded on a national U.S. security exchange with certificates issued in the name of the individual surety (these assets will be accepted at 90 percent of their 52-week low, as reflected at the time of submission of the bond)

(4) Real property owned in fee simple by the surety without any form of concurrent ownership (these assets will be accepted at 100 percent of the most current tax assessment value exclusive of encumbrances or 75 percent of the properties' unencumbered market value provided a current appraisal is furnished)

(5) Irrevocable letters of credit (ILC) issued by a federally insured financial institution in the name of the contracting agency and which identify the agency and solicitation or contract number for which the ILC is provided.

(d) Unacceptable assets include but are not limited to:

(1) Notes or accounts receivable;

(2) Foreign securities;

(3) Real property as follows:

a. Real property located outside the United States, its territories, or possessions.

b. Real property which is a principal residence of the surety.

c. Real property owned concurrently regardless of the form of co-tenancy except where all co-tenants agree to act jointly.

d. Life estates, leasehold estates, or future interests in real property.

(4) Personal property such as jewelry, furs, antiques;

(5) Stocks and bonds of the individual surety in a controlled, affiliated, or closely held concern of the Offeror/Contractor;

(6) Corporate assets (e.g., plant and equipment);

(7) Speculative assets (e.g., mineral rights);

(8) Letters of credit, except as provided in subparagraph c(5) above.

(e) With respect to the acceptance of real property, the individual surety shall provide:

(1) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice;

(2) Evidence of the amount due under any encumbrance shown in the evidence of title

(3) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice.

(4) Failure to provide evidence that the lien has been properly recorded will render the offeror nonresponsible.

(f) An individual may be excluded from acting as individual surety on bonds for any of the following causes:

(1) Failure to fulfill the obligations under any bond.

(2) Failure to disclose all bond obligations.

(3) Misrepresentation of the value of available assets or outstanding liabilities.

(4) Any false or misleading statement, signature or representation on a bond or affidavit of individual suretyship.

(5) Any other cause affecting responsibility as a surety of such serious and compelling nature as may be determined to warrant exclusion.

An individual surety excluded pursuant to this subsection shall be included on the list entitled "Parties Excluded from Procurement Programs."

(g) Any bidder or offeror should carefully review these requirements which are set forth in Section 28 of the Federal Acquisition Regulations (FAR).

28 March 1998

Choice 1

(1)5. SITE VISIT (CONSTRUCTION) FAR 52.236-27 (FEB 1995).

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract award as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) Site visits may be arranged during normal duty hours by contacting:

Ft. Knox Area Office
Building 122, Binter Street
Ft. Knox, Kentucky 40121-5000
Telephone: 502-624-5468

3 June 1998

6. REQUESTS FOR INFORMATION relating to this procurement should be directed to the Louisville District, Corps of Engineers, as follows:

Procurement of Plans

& Specifications-Barbara Rich.....502/582-5815
Prospective Offerors may find the planholders list on the Internet at
http://www.orl/usace.army.mil/ceorl1/ct_pages.htm

Technical Questions on Plans

& Specifications-Mike Haag.....502/582-6245
or George Flickner.....502/582-6120

31 October 1997

7. AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (JUN 1997) FAR 52.211-1

(a) A single copy of each specification cited in this solicitation is available without charge from the GSA Federal Supply Service Bureau Specifications Section (3FBP-W), 470 East L'Enfant Plaza, SW., Suite 8100, Washington, D.C. 20407 (Tel. 202-619-8925). Additional copies may be purchased from the GSA Specifications Section in Washington, D.C.

(b) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

31 October 1997

8. AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) (JUN 1997) FAR 52.211-2.

Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point listed below. The request must contain the title of the solicitation, its number, date, applicable amendment(s), and the solicitation or contract number. A telephone order entry system is available with the use of a touch tone telephone. A Customer Number is required to use this system and may be obtained in written request to the address listed below or by telephone (215-697-2179). In case of urgency, telegraphic requests are acceptable. Voluntary standards, which are not available to offerors and Contractors from Government sources, may be obtained from the organization responsible for their preparation, maintenance, or publication.

Standardization Documents
Order Desk, Building 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Fax Number 215-697-2978

20 March 1997

9. AVAILABILITY OF SPECIFICATIONS AND STANDARDS NOT LISTED IN DODISS, DATA ITEM DESCRIPTIONS NOT LISTED IN DOD 5010.12-L, AND PLANS, DRAWINGS, AND OTHER PERTINENT DOCUMENTS (DEC 1991) DFARS 252.211-7001

Offerors may obtain the specifications, standards, plans, drawings, data item descriptions, and other pertinent documents cited in this solicitation by submitting a request to:

As stated in Paragraph 6.

Include the number of the solicitation and the title and number of the specification, standard, plan, drawings, or other pertinent document.

10. NOT USED.

2 Jan 1996

11. INDUSTRY SMALL BUSINESS SIZE STANDARDS FAR 19.102.

11.1 General.

(a) The SBA establishes small business size standards on an industry-by-industry basis. These size standards are also set forth in SBA's regulations at 13 CFR 121.

(b) Small business size standards are applied by--

(1) Classifying the product or service being acquired in the industry whose definition, as found in the Standard Industrial Classification (SIC) Manual, best describes the principal nature of the product or service being acquired.

(2) Identifying the size standard SBA established for that industry; and

(3) Specifying the size standard in the solicitation, so that offerors can appropriately represent themselves as small or large.

(c) For size standard purposes, a product or service shall be classified in only one industry, whose definition best describes the principal nature of the product or service being acquired even though for other purposes it could be classified in more than one.

(d) When acquiring a product or service that could be classified in two or more industries with different size standards, contracting officers shall apply the size standard for the industry accounting for the greatest percentage of the contract price.

(e) If a solicitation calls for more than one item and allows offers to be submitted on any or all of the items, an offeror must meet the size standard for each item it offers to furnish. If a solicitation calling for more than one item requires offers on all or none of the items, an offeror may qualify as a small business by meeting the size standard for the item accounting for the greatest percentage of the total contract price.

(f) Any concern which submits a bid or offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is deemed to be a small business when--

(1) In the case of Government acquisitions set-aside for small businesses, such nonmanufacturer must furnish in the performance of the contract the product of a small business manufacturer or producer, which end product must be manufactured or produced in the United States. The term "nonmanufacturer" includes a concern which can manufacture or produce the product referred to in the specific acquisition but does not do so in connection with that acquisition. For size determination purposes there can be only one manufacturer of the end item being procured. The manufacturer of the end item being acquired is the concern which, with its own forces, transforms inorganic or organic substances including raw materials and/or miscellaneous parts or components into such end item. Whether an offeror on a particular acquisition is the manufacturer or a nonmanufacturer for the purpose of a size determination need not be consistent with whether such concern is or is not a manufacturer for the purpose of the Walsh-Healey Act.

(2) A concern which purchases items and packages them into a kit is considered to be a nonmanufacturer small business and can qualify as such for a given acquisition if it meets the size qualifications of a small nonmanufacturer for the acquisition, and if more than 50 percent of the total value of the kit and its contents is accounted for by items manufactured by small business.

(3) If the acquisition is subject to and is actually procured under "small purchase procedures", such nonmanufacturer may furnish any domestically produced or manufactured product.

(4) For the purpose of receiving a Certificate of Competency on an unrestricted acquisition, a small business nonmanufacturer may furnish any domestically produced or manufactured product. The applicable size standard shall be that of the wholesale industry of the item being acquired.

11.2 The industry size standards are set forth in the following table. The

table column labeled "SIC" follows the standard industrial classification code as published by the Government in the Standard Industrial Classification Manual. The Manual is intended to cover the entire field of economic activities. It classifies and defines activities by industry categories and is the source used by SBA as a guide in defining industries for size standards. The number of employees or annual receipts indicates the maximum allowed for a concern, including its affiliates, to be considered small.

11.3 Size standards for construction and special trades.

A concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed \$17 million. However, if 75 percent or more of the work (in terms of dollar value) called for by the contract is classified in one of the industries, subindustries, or classes of products listed in this paragraph, the concern is small if its average annual receipts for its preceding 3 fiscal years did not exceed the size standard for that industry, subindustry, or class of products. (See Division C, "Contract Construction," of the SIC Manual).

| Classification Code | Industry, Subindustry, or Class of Products | Size Standard* |
|---------------------|---|----------------|
|---------------------|---|----------------|

MAJOR GROUP 15--BUILDING CONSTRUCTION--GENERAL CONTRACTORS AND OPERATIVE BUILDERS

| | | |
|------|--|--------|
| 1521 | General Contractors--Single-Family House | \$17.0 |
| 1522 | General Contractors--Residential Buildings, Other Than Single-Family | 17.0 |
| 1531 | Operative Builders | 17.0 |
| 1541 | General Contractors--Industrial Buildings and Warehouses | 17.0 |
| 1542 | General Contractors--Nonresidential Buildings Other Than Industrial Buildings and Warehouse | 17.0 |

MAJOR GROUP 16--CONSTRUCTION OTHER THAN BUILDING CONSTRUCTION--GENERAL CONTRACTORS

| | | |
|------|---|------|
| 1611 | Highway and Street Construction, Except Elevated Highway | 17.0 |
| 1622 | Bridge, Tunnel, and Elevated Highway Construction | 17.0 |
| 1623 | Water, Sewer, Pipe Line, Communication and Power Line Construction | 17.0 |
| 1629 | Heavy Construction, Except Dredging N.E.C. | 17.0 |
| 1629 | Dredging and Surface Cleanup Activities | 13.5 |

MAJOR GROUP 17--CONSTRUCTION--SPECIAL TRADE CONTRACTORS

| | | |
|------|---|---|
| 1711 | Plumbing, heating (except electric), and air conditioning | 7 |
| 1721 | Painting, paperhanging, and decorating | 7 |
| 1731 | Electrical Work | 7 |
| 1741 | Masonry, stone setting, and other stonework | 7 |
| 1742 | Plastering, drywall, acoustical and insulation work | 7 |
| 1743 | Terrazzo, tile, marble, and mosaic work | 7 |
| 1751 | Carpentering and flooring | 7 |
| 1752 | Floor laying and other floorwork, not elsewhere classified | 7 |

| | | |
|--|---|---|
| 1761 | Roofing and sheet metal work | 7 |
| 1771 | Concrete work | 7 |
| 1781 | Water well drilling | 7 |
| 1791 | Structural steel erection | 7 |
| 1793 | Glass and glazing work | 7 |
| 1794 | Excavating and foundation work | 7 |
| 1795 | Wrecking and demolition work | 7 |
| 1796 | Installation or erection of building equipment, not elsewhere classified | 7 |
| 1799 | Special trade contractors, not elsewhere classified | 7 |
| * (Average Annual Receipts) (Millions) | | |

12. CONTRACT PRICES - BIDDING SCHEDULES (DEC 1991) DFARS 52.236-7008.

(a) The Government's payment for the items listed in the Bidding Schedule shall constitute full compensation to the Contractor for--

(1) Furnishing all plant, labor, equipment, appliances, and materials; and

(2) Performing all operations required to complete the work in conformity with the drawings and specifications.

(b) The Contractor shall include in the prices for the items in the Bidding Schedule all costs for work in the specifications, whether or not specifically listed in the Bidding Schedule.

2 Jan 96

13. ARITHMETIC DISCREPANCIES EFARS 52.214-5000.

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by the offeror:

(1) Obviously misplaced decimal points will be corrected;

(2) In case of discrepancy between unit prices and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the offeror intends his offer to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

(c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

1 February 1995

14. WAGE RATES. The Wage Decisions of the Secretary of Labor are applicable to the work to be performed under this contract and are contained in SECTION 00800, SPECIAL CONTRACT REQUIREMENTS. Modifications are periodically made to the wage decisions. The complete modifications will be issued by amendment to

the solicitation.

15. NOTICE OF BUY AMERICAN ACT REQUIREMENT--CONSTRUCTION MATERIALS
UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (MAY 1997)
FAR 52.225-13

(a) Offerors are required to comply with the requirements of Federal Acquisition Regulation (FAR) clause 52.225-15, Buy American Act--Construction Materials Under Trade Agreements Act and North American Free Trade Agreement, of this solicitation. The terms defined in FAR clause 52.225-15 have the same meaning in this provision.

(b) Offerors should request a determination regarding the inapplicability of the Buy American Act in time to allow determination before submission of offers. For evaluation of a request for a determination regarding the inapplicability of the requirements of the Buy American Act prior to the time set for receipt of offers, the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-15 shall be included in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act prior to submission of its offer, or has not received a response to a request made prior to submission of its offer, the information and supporting data shall be included in the offer.

(c) Evaluation of offers.

(1) For evaluation of offers, (unless agency regulations specify a higher percentage) the Government will add to the offered price 6 percent of the cost of any foreign construction material proposed for exception from the requirements of the Buy American Act based on claimed unreasonable cost of domestic construction materials in accordance with paragraph (b)(4)(i) of FAR clause 52.225-15.

(2) If the evaluation of offers results in a tie between an offer including such foreign construction material excepted on the basis of unreasonable cost, as evaluated, and an offer including solely domestic construction material or other foreign construction material, listed in the solicitation at paragraph (b)(3) of FAR clause 52.225-15, or subsequently excepted in accordance with paragraphs (b)(4)(ii) or (iii) of FAR clause 52.225-15, award shall be made to the offeror that submitted the latter offer.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in the solicitation at paragraph (b)(3) of FAR clause 52.225-15, offerors also may submit alternate offers based on use of equivalent domestic construction material.

(2) If alternate offers are submitted, a separate Standard Form 1442 shall be submitted for each alternate offer, and a separate price comparison table, prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-15, shall be submitted for each offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception to apply.

(3) If the Government determines that a particular exception requested under paragraph (c) of FAR clause 52.225-15 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic

construction material, and the offeror shall be required to furnish such domestic construction material.

(i) In sealed bid procurements, any offer based on use of that particular foreign construction material shall be rejected as nonresponsive.

(ii) In negotiated procurements, any offer based on use of that particular foreign construction material may not be accepted unless revised during negotiations.

16. LISTING OF EMPLOYMENT OPENINGS. Offerors should note that this solicitation includes a provision requiring the listing of employment openings with the local office of the State employment service system if the award is for \$10,000 or more.

17. NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (APR 1984) FAR 52.222-23.

(a) The Offeror's attention is called to the EQUAL OPPORTUNITY and the AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION clauses of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

| | |
|---|--|
| | |
| Goals for minority participation for each trade | Goals for female participation in each trade |
| 9.6 % | 6.9% |
| | |

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted) performed in the covered area. If the Contractor performs construction work (whether or not it is Federal or Federally assisted) in a geographical area located outside the covered area, it shall apply the goals established for the geographical area where such work is actually performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs (OFCCP) Office.

(c) The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity clause, specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction" and its efforts to meet prescribed goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be

measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Director, OFCC within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor, employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in the contract resulting from this Solicitation, the "covered area" is Louisville, Kentucky economic Area which includes Hardin County, Kentucky.

28 March 1998

18. SUBCONTRACTING PLANS FOR SMALL, SMALL DISADVANTAGED, AND WOMEN-OWNED SMALL BUSINESS CONCERNS. Offerors are cautioned that compliance with CONTRACT CLAUSE: SMALL, SMALL DISADVANTAGED, AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN requires that the offeror, if a large business, submit a subcontracting plan for subcontracting with small, small disadvantaged, and women-owned small business concerns. Offerors desiring assistance in developing a source list are encouraged to contact small, small disadvantaged, and women-owned small business concerns, associations and appropriate Offices of Small and Disadvantaged Business Utilization, addresses which may be obtained from the District Labor Adviser, U.S. Army Engineer District, P.O. Box 59, Louisville, Kentucky 40201 (Telephone 502/582-5679).

19. PERFORMANCE OF WORK BY CONTRACTOR. Attention is directed to SPECIAL CONTRACT REQUIREMENT: PERFORMANCE OF WORK BY CONTRACTOR. The successful offeror must furnish the Contracting Officer, within 5 days after award, a description of the work which he intends to perform with his own organization, e.g., earthwork, paving, brickwork, or roofing), the percentage of the total work this represents, and the estimated cost thereof.

20. PAYMENT FOR BOND PREMIUMS. CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS provides that upon presentation of evidence of full payment, the Government will immediately reimburse the Contractor the cost of premiums for performance and payment bonds. This reimbursement amount is not in addition to the amount offered for the work covered by this Request for Proposals, and offerors are cautioned to include the cost of such premiums in the offer items shown on the Bidding Schedule (or in the lump sum amount of the offer if no offer items are listed). If bond premiums are reimbursed under this clause, such reimbursed amount will be recovered by the Government from the progress payments made to the Contractor or, if no progress payments are made, from the amount otherwise due the Contractor upon final payment.

21. NOT USED.

22. COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (DEC 1991)
DFARS 252.204-7001

(a) The Offeror is requested to enter a CAGE code on its offer in the block with its name and address. The CAGE code entered must be for that name and address. Enter CAGE before the number.

(b) If the Offeror does not have a CAGE code, it may ask the Contracting Officer to request one from the Defense Logistics Services Center (DLSC). The

Contracting Officer will--

(1) Ask the Contractor to complete section B of a DD Form 2051, Request for Assignment of a Commercial and Government Entity (CAGE) Code;

(2) Complete section A and forward the form to DLSC; and

(3) Notify the Contractor of its assigned CAGE code.

(c) Do not delay submission of the offer pending receipt of a CAGE code.

23. NOT USED.

28 March 1998

24. SERVICE OF PROTEST (AUG 1996) FAR 52.233-2.

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO) shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

Ms. Janet M. Henderzahs, Contracting Officer
U. S. Army Engineer District, Louisville
Corps of Engineers - ATTN: CEORLCT
600 Dr. Martin Luther King, Jr. Place, Room 821
Louisville, KY 40201-0059

(b) The copy of any protest shall be received in the office designated above on the same day a protest is filed with the GSBGA or within one day of filing a protest with the GAO.

20 March 1997

25. DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (APR 1998) FAR 52.204-6

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet Information Services.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

(c) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

- (1) Company name.
- (2) Company address.
- (3) Company telephone number.
- (4) Line of business.

- (5) Chief executive officer/key manager.
- (6) Date the company was started.
- (7) Number of people employed by the company.
- (8) Company affiliation.

(d) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet Home Page at <http://www.dbisna.com/dbis/customer/custlist.htm>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@dbisma.com.

20 March 1997

26. NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990) FAR 52.211-14.

Any contract awarded as a result of this solicitation will be a [] DX rated order; [X] DO-C2 rated order certified for national defense use under the Defense Priorities and Allocations System (DFARS) 15 CFR 700, and the Contractor will be required to follow all of the requirements of this regulation.

27. PRICE BASIS. Prices must be firm. Offers will not be considered which provide for subsequent increase in price.

28. RESTRICTIVE LIMITATION

(a) Except for Additives and Options, the Government shall accept all items listed in Schedule 00010 of this solicitation.

(b) Offers may not be submitted for quantities less than those specified.

29. AWARD TO SINGLE OFFERS. Subject to the provisions contained herein, award shall be to a single offeror.

22 June 1998

30. SUBMISSION OF INVOICES

In accordance with Section 00010, Para. 24, submit invoices to:

Ft. Knox Area Office
Building 122, Binter Street
Ft. Knox, Kentucky 40121-5000
Telephone: 502-624-5468

31. NOT USED.

20 March 1997

(2) 32. EVALUATION OF OPTIONS (JUL 1990) FAR 52.217-5

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

33. NOT USED.

**¹SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL
BUSINESS SUBCONTRACTING PLAN**

DATE:_____

CONTRACTOR:_____

ADDRESS:_____

SOLICITATION OR CONTRACT NUMBER:_____

ITEM/SERVICE:_____

The following, together with any attachments, is hereby submitted as a Subcontracting Plan to satisfy the applicable requirements of Public Law 95-507 as implemented by OFPP Policy Letter 80-2.

1. (a) The following goals (expressed in terms of a percentage and dollar values of total planned subcontracting dollars) are applicable to the contract or solicitation cited above.

See page 1a

- (b) The following principal products and/or services will be subcontracted under this contract, and the distribution among small, small disadvantaged and women-owned small business concerns is as follows:

(Designated products/services to be subcontracted to: small business concerns by "*" small disadvantaged business concerns by "*"; and women-owned small business concerns by "****")**

(ATTACHMENT MAY BE USED IF ADDITIONAL SPACE IS REQUIRED)

- (c) The following method was used in developing subcontract goals (i.e., Statement explaining how the product and service areas to be subcontracted were established, how the areas to be subcontracted to small, small disadvantaged and women-owned small business concerns were determined, and how small, small disadvantaged and women-owned small business concerns'
- _____

capabilities were determined, to include identification of source lists utilized in making those determinations).

(d) Indirect and overhead costs (check one): ____ have been ____ have not been included in the goals specified in 1(a) and 1(b).

(e) If "have been" is checked, explain the method used in determining the proportionate share of indirect and overhead cost to be allocated as subcontracts to small, small disadvantaged and women-owned small business concerns.

2. The following individual will administer the subcontracting program:

Name & Title: _____

Address & Telephone: _____

This individual's specific duties, as they relate to the firm's subcontracting program, are as follows:

General overall responsibility for this company's Small Business Program, the development, preparation and execution of individual subcontracting plans and for monitoring performance relative to contractual subcontracting requirements contained in this plan, including but not limited to:

(a) Developing and maintaining offerors/bidders lists of small, small disadvantaged and women-owned small business concerns from all possible sources.

(b) Ensuring that procurement packages are structured to permit small, small disadvantaged and women-owned small business concerns to participate to the maximum extent possible.

(c) Assuring inclusion of small, small disadvantaged and women-owned small business concerns in all solicitations for products or services which they are capable of providing.

(d) Reviewing solicitations to remove statements, clauses, etc., which may tend to restrict or prohibit small, small disadvantaged and women-owned small business participation.

(e) Ensuring periodic rotation of potential subcontractors on bidders lists.

(f) Ensuring that the bid proposal review board documents its reasons for not selecting low bids submitted by small, small disadvantaged and women-owned small business concerns.

(g) Ensuring the establishment and maintenance of records of solicitations and subcontract award activity.

(h) Attending or arranging for attendance of company counselors at Business Opportunity Workshops, Minority Business Enterprise Seminars, Trade Fairs, etc.

(i) Conducting or arranging for conduct of motivational training for purchasing personnel pursuant to the intent of Public Law 95-507.

(j) Monitoring attainment of proposed goals.

(k) Preparing and submitting periodic subcontracting reports required, which will include Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and SF 295, Summary Subcontract Report, in accordance with the instructions on the forms.

(l) Coordinating contractor's activities during the conduct of compliance reviews by Federal agencies.

(m) Coordinating the conduct of contractor's activities involving its small, small disadvantaged, and women-owned small business subcontracting program.

(n) Additions to (or deletions from) the duties specified above are as follows:

3. The following efforts will be taken to assure that small, small disadvantaged and women-owned small business concerns will have an equitable opportunity to compete for subcontracts:

(a) Outreach efforts will be made by:

(i) Contacts with minority and small business trade associations.

(ii) Contacts with business development organizations.

(iii) Attendance at small and minority business procurement conferences and trade fairs.

(iv) Sources will be requested from Small Business Administration's appropriate Procurement Center Representative.

(b) The following internal efforts will be made to guide and encourage buyers:

(i) Workshops, seminars and training programs will be conducted.

(ii) Activities will be monitored to evaluate compliance with this subcontracting plan.

(c) Small, small disadvantaged and women-owned small business concern source lists, guides and other data identifying small, small disadvantaged and women-owned small business concerns will be maintained and utilized by buyers in soliciting subcontracts.

(d) Additions to (or deletion from) the above listed efforts are as follows:

4. The offeror (contractor) agrees that the clause entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" will be included in all subcontracts which offer further subcontracting opportunities, and all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 in construction) will be required to adopt and comply with a subcontracting plan similar to this one. Such plans will be reviewed by comparing them with the provisions of Public Law 95-507, and assuring that all minimum requirements of an acceptable subcontracting plan have been satisfied. The acceptability of percentage goals shall be determined on a case-by-case basis depending on the supplies/services involved, the availability of potential small, small disadvantaged and women-owned small business subcontractors, and prior experience. Once approved and implemented, plans will be monitored through the submission of periodic reports, and/or, as time and availability of funds permit, periodic visits to subcontractors facilities to review applicable records and subcontracting program progress.

5. The offeror (contractor) agrees to submit such periodic reports and cooperate in any studies or surveys as may be required by the contracting agency or the Small Business Administration in order to determine the extent of compliance by the offeror with the subcontracting plan and with the clause entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business

Concerns," contained in the contract. The above reports will include Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and SF 295, Summary Subcontract Report, in accordance with the instructions on the forms.

6. The offeror (contractor) agrees that he will maintain at least the following types of records to document compliance with this subcontracting plan:

(a) Small, small disadvantaged and women-owned small business concern source lists, guides and other data identifying SB/SDB concerns.

(b) Organizations contacted for small, small disadvantaged and women-owned small business sources.

(c) On a contract-by-contract basis, records on all subcontract solicitations over \$100,000, indicating on each solicitation (i) whether small business concerns were solicited, and if not, why not; (ii) whether small disadvantaged business concerns were solicited, and if not, why not; (iii) whether women-owned small business concerns were solicited, and if not, why not; and (iv) reasons for the failure of solicited small, small disadvantaged or women-owned small business concerns to receive the subcontract award.

(d) Records to support other outreach efforts: Contracts with Minority and Small Business Trade Associations, etc., and attendance at small and minority business procurement conferences and trade fairs.

(e) Records to support internal activities to guide and encourage buyers: Workshops, seminars, training programs, etc., monitoring activities to evaluate compliance.

(f) On a contract-by-contract basis, records to support subcontract award data to include name and address and business size of each subcontractor.

(g) Records to be maintained in addition to the above are as follows:

Signed:_____ Date:_____

Typed Name and Title:_____

Plan Accepted by:_____ Date:_____

Contracting Officer

NOTE TO CONTRACTING OFFICER: Upon incorporation of a plan into the contract indicated herein, the estimated dollar value of contract \$_____

CONTINUATION OF PARAGRAPH 1(a)

| BASIC CONTRACT | Dollars | Percents |
|---|---------|----------|
| 1. Total basic contract price | _____ | |
| 2. Total to be subcontracted (to all types of business concerns) | _____ | _____ |
| a. To large business | _____ | _____ |
| b. To small business | _____ | _____ |
| i. To nondisadvantaged small business | _____ | _____ |
| ii. To disadvantaged small business | _____ | _____ |
| iii. To women-owned small business | _____ | _____ |

OPTIONS (if required)

NAME OF OPTION: _____

| | Dollars | Percents |
|---|---------|----------|
| 1. Total option price | _____ | |
| 2. Total to be subcontracted (to all types of business concerns) | _____ | _____ |
| a. To large business | _____ | _____ |
| b. To small business | _____ | _____ |
| i. To nondisadvantaged small business | _____ | _____ |
| ii. To disadvantaged small business | _____ | _____ |
| iii. To women-owned small business | _____ | _____ |

(SUBMIT ADDITIONAL OPTION PAGES FOR EACH OPTION)

OPTIONS (if required)

NAME OF OPTION: _____

| | Dollars | Percents |
|---|---------|----------|
| 1. Total option price | _____ | |
| 2. Total to be subcontracted (to all types of business concerns) | _____ | 100% |
| a. To large business | _____ | _____ |
| b. To small business | _____ | _____ |
| i. To nondisadvantaged small business | _____ | _____ |
| ii. To disadvantaged small business | _____ | _____ |
| iii. To women-owned small business | _____ | _____ |

NAME OF OPTION: _____

| | Dollars | Percents |
|---|---------|----------|
| 1. Total option price | _____ | |
| 2. Total to be subcontracted (to all types of business concerns) | _____ | 100% |
| a. To large business | _____ | _____ |
| b. To small business | _____ | _____ |
| i. To nondisadvantaged small business | _____ | _____ |
| ii. To disadvantaged small business | _____ | _____ |
| iii. To women-owned small business | _____ | _____ |

ARMY FEDERAL ACQUISITION REGULATION SUPPLEMENT

APPENDIX CC -- SUBCONTRACTING PLAN EVALUATION GUIDE

PART 2--SCORING SYSTEM

| | <u>Range</u> | <u>Point Assigned</u> | <u>Points</u> |
|--|--------------|-----------------------|---------------|
| 1. Policy statement or evidence of internal guidance to company buyers recognizing commitment to Pub.L. 99-661, Section 1207, and Pub.L. 100-180, Section 806. | 0-5 | | |

0 No written policy statement in plan.

1-2 Plan includes a general policy, but no evidence of recognition of special emphasis being placed on subcontracting with SDBs, HBCUs and MIs as a result of Pub.L.s.

3-5 Definitive corporate and management commitment evidenced in individual plan and master plan by specifically referencing the Pub.L.s.

| | <u>Point Range</u> | <u>Points Assigned</u> |
|--|--------------------|------------------------|
| 2. Efforts to broaden SB and SDB active vendor base. (FAR 19.704(a), 52.219-9(d), DFARS Subpart 219.5, 219.704(a)(1), 219.705 and 252.219-7003) | 0-10 | |

0 Description of efforts merely parrots requirements of FAR to maintain listing of vendors.

1-2 Contains evidence that effort is directed at increasing subcontracts to SBs and SDBs for non-complex and general housekeeping supplies or services normally awarded to firms already in existing vendor base.

3-10 Addresses efforts to increase the number of SB and SDB sources awarded subcontracts, establishes plans to use competition restricted to SDBs and gives details about how plans to use competition restricted to SDBs will be accomplished. (DFARS 219.705-4 and Subpart 219.5)

NOTE: After scoring the plan to this point, if zero points have been assigned for Element 2, proceed to Item 3, Outreach. If one or more points have been assigned for this Element 2, proceed to evaluation of the subelements labeled "minus 2" and "minus 3" to determine if points assigned so far must be reduced. Do not reduce points already assigned to less than zero. (No negative points are to be entered under "Points Assigned" for any Element.) These negative scores are additive; if both of the subelements apply, then minus five points are assessed to reduce points already assigned under this element 2.

minus 2 Includes efforts described above which rate 1-2 or 3-10 points but, when it would be appropriate, does not address effort to involve HBCUs and MIs in performing the contract for which the subcontracting plan is submitted. (DFARS 219.704(a)(1) and 219.705-4(d))

ARMY FEDERAL ACQUISITION REGULATION SUPPLEMENT

APPENDIX CC -- SUBCONTRACTING PLAN EVALUATION GUIDE

minus 3 Includes efforts described above which rate 1-2 or 3-10 points but does not address effort to identify and overcome obstacles which may prohibit award to HBCU and MI sources currently in vendor base.

| | Point Range | Points Assigned |
|---|----------------|--------------------|
| 3. Outreach (ongoing and planned actions) (FAR 19.704(a), 19.705-4, 52.219-9(d) and 52.219-9(e), DFARS 219.705). | 0-10 | |
| 0 No mention of outreach. | | |
| 1-4 Describes efforts to work with organizations in FAR 52.219-9(d)(11)(iv) to identify potential sources for items not traditionally awarded to SB or SDB firms. (FAR 52.219-9(d)(11)(iv) and 52.219-9(e)) | | |
| 5-10 Indicates intent to conduct reviews to determine the competence, ability, experience and capacity available in SB or SDB firms and to provide technical assistance to SBs and SDBs or explains why such reviews or technical assistance are not appropriate. (FAR 19.705-4(c) and 52.219-9(e)) | | |
| NOTE: After scoring the plan to this point, if zero points have been assigned for Element 3, proceed to Item 4, Description of supplies and services. If one or more points have been assigned for this Element 3, proceed to evaluation of the subelement labeled "minus 3" to determine if points assigned so far must be reduced. Do not reduce points already assigned to less than zero. (No negative points are to be entered under "Points Assigned" for any Element.) | | |
| minus 3 Fails to indicate the extent to which HBCU and MI participation will be considered and facilitated in performing the contract for which the subcontracting plan is submitted, or fails to indicate other efforts to increase HBCU and MI participation in future DoD acquisitions. (DFARS 219.705-4(d)) | | |

| | Point Range | Points Assigned |
|--|----------------|--------------------|
| 4. Describes supplies and services to be subcontracted and planned for subcontracting to SBs, SDBs, HBCUs and MIs. (FAR 19.705-4(d), 52.219-9(d)(3), 52.219-9(e) and DFARS 219.705). | 0-10 | |
| 0 No mention. | | |
| 1-4 Generic list of routine supplies and services included in materials listing for the specific contract. | | |

ARMY FEDERAL ACQUISITION REGULATION SUPPLEMENT

APPENDIX CC -- SUBCONTRACTING PLAN EVALUATION GUIDE

5-7 Indicates intent to review major product/system components and key project elements of R&D, construction, service and spare parts contracts for subcontracting to SBs, SDBs, HBCUs and MIs. (FAR 19.705-4(d)(3) and (4), 52.219-9(e)(1) and (2) and DFARS 219.705)

8-10 Substantive plan actually targets specific SBs, SDBs, HCBUs and MIs for review to determine their competence, ability, experience and capacity and identifies specific components or major portions of the acquisition for consideration of SB, SDB, HBCU or MI competition. Also, indicates intent to work with large business subcontractors for major subsystems or key project elements to ensure "flowdown" of this philosophy. (FAR 19.705-4(d) and DFARS 219.705)

| | Point Range | Points Assigned |
|--|----------------|--------------------|
| 5. Describes specific efforts, based on results of efforts described in Elements No. 3 and No. 4 to ensure that SB, SDB, HBCU and MI concerns have equitable opportunity to participate in acquisitions. (FAR 19.704(a), 19.705-4, 52.219-9(d) and DFARS 219.705). | 0-15 | |
| 0 No mention. | | |
| 1-4 Description of efforts merely parrots FAR 19.704(a)(3) and (6) and 52.219-9(d)(8). | | |
| 5-8 Describes how the company intends to evaluate its own SB and SDB award performance and program effectiveness against the established goals, both company-wide and for the individual plan being negotiated. (FAR 19.704(a)(1) and (6) and 52.219-9(d)(11)(v)) | | |
| 9-12 Includes SBs, SDBs, HBCUs and MIs by name as members of original team for producing specific major components or subassemblies, providing a major service or performing a significant portion of the effort. (DFARS 219.705-2(d)) | | |
| 13-15 Describes special efforts to establish long-range relationships with SBs, SDBs, HBCUs and MIs, including leader-follower techniques, when appropriate. (FAR 19.705-4(d)(4) and DFARS 219.705-2(d)) | | |

| | Point Range | Points Assigned |
|---|----------------|--------------------|
| 6. Development of percentage goal is based on planned subcontracting which is challenging, yet realistic. (FAR 19.705-4(d), DFARS 219.704(a)(1) and 219.705-4). | 0-40 | |
| 0 Fails to include a specific goal for subcontracting with SBs, SDBs, HBCUs and MIs or proposes zero percent goal without substantive justification. | | |
| 1-5 Sets small business goal of less than 10 percent and/or SDB/HBCU/MI goal of two percent or less with no significant justification. | | |

ARMY FEDERAL ACQUISITION REGULATION SUPPLEMENT

APPENDIX CC -- SUBCONTRACTING PLAN EVALUATION GUIDE

6-10 Sets goals of less than 10 percent (SB) and 2 percent (SDB), but contractor shows evidence of reasonable effort, including use of set-asides, to involve SBs, SDBs, HBCUs or MIs in non-traditional areas.

11-20 Sets goals of over 10 percent (SB) and 2 percent (SDB) and also identifies specific SB, SDB, HBCU or MI concerns planned to be subcontractors, including the item or service or effort to be subcontracted. Indicates extent to which firms have participated in proposal preparation or otherwise indicates extent to which subcontracting to these firms may reasonably be assured. Goals are realistic in view of actions stated in other portions of the plan and make-or-buy plan, if applicable.

21-30 Same as for 11-20 points, but proposed percent of goal is reasonable in comparison with prior experience, yet indicates reasonable effort to improve on past experience in terms of dollars, number of SDBs, HBCUs, and MIs involved, and movement into area without previous SDB, HBCU or MI involvement.

31-40 Same as 21-30 points, but includes evidence that if SBs, universities or institutions other than HBCUs or MIs are performing on a major component or subassembly, providing a major service or performing on a key project element, SDBs, HBCUs and MIs will also be given an opportunity to perform. Also, the percentage of the SDB, HBCU, MI goal compares favorably with the percentage of SB goal, consistent with the Government-wide goals of 20 percent to SB with five percent to SDB, or is otherwise explained, and the plan includes a forecast for improvement. (The SB and SDB goals in the subcontracting plan should approximate the ratio between the SB and SDB Government-wide goals.)

| Point Range | Points Assigned |
|----------------|--------------------|
|----------------|--------------------|

7. Past performance.

0-10

Extent to which the company has historically been successful in establishing realistic, yet challenging, goals and achieving them. Consider DCMC comments on prime contractor's justifications for prior failure to achieve goals. To avoid penalizing the contractor when there has been no previous defense contract, assign 10 points. (FAR 19.705-4(d)(1) and (d)(2)(iii), 19.706 and DFARS 219.706).

8. Other regulatory and statutory requirements.

If any of the following are answered "NO," the plan is not acceptable and must be revised to comply prior to award:

Does the plan have--

A. A separate goal for SB and SDB? (FAR 19.704(a)(1) and FAR 52.219-9(d)(1) and (2))

YES ____ NO ____

ARMY FEDERAL ACQUISITION REGULATION SUPPLEMENT

APPENDIX CC -- SUBCONTRACTING PLAN EVALUATION GUIDE

- B. A separate goal for the basic contract and, if applicable, each option? (FAR 19.704(c))
YES ____ NO ____
- C. The name of the company employee responsible for administration of plan and employee's duties? (FAR 19.704(a)(2) and 52.219-9(d)(7))
YES ____ NO ____
- D. A statement affirming intent to comply with subcontracting "flowdown" provisions? (FAR 19.704(a)(4) and 52.219-9(d)(10))
YES ____ NO ____
- E. A statement affirming willingness to cooperate in studies and to provide reports? (FAR 19.704(a)(5) and 52.219-9(d)(10))
YES ____ NO ____
- F. A statement that indirect costs are either included or excluded from the proposed goals and, if included, how they will be prorated? (FAR 52.219-9(d)(6))
YES ____ NO ____
- G. A description of efforts to ensure that SBs and SDBs have an equitable opportunity to participate in the acquisition? (FAR 52.219-9(d)(8))
YES ____ NO ____
- H. A recitation of the types of records maintained to demonstrate procedures adopted to comply with the requirements and goal in the plan? (FAR 52.219-9(d)(11))
YES ____ NO ____

SECTION 00115

PROCEDURES FOR SUBMITTAL OF OFFERS

1. Where to Submit. Offerors shall submit the below-listed number of proposal packages to the Corps of Engineers at the address shown in Section 00010, Block 8 of Standard Form 1442, Room 821.
2. Submission Deadline. Proposals shall be received by the Corps of Engineers no later than the time and date specified in Section 00010, Block 13 of Standard Form 1442. All information requested by Sections 1 through 6 must be submitted for the proposal to be considered competitive.
3. Submission Format and Number of Submittals. All proposed materials shall be submitted in binders with a table of contents and tabbed section dividers. The sections should parallel the submission requirements identified below. Sections 1, 3, and 4 should be submitted in original and 4 copies. Sections 2, 5, and 6 should be submitted in original and two copies and should be placed in a separate envelope.

Section 1: Previous Experience

- a. The Contractor should demonstrate knowledge, skill and experience in construction of firing ranges by providing a narrative description of his abilities. The Contractor should demonstrate construction experience in performing construction activities in high explosive duded areas. List projects and safety plan which demonstrates personnel protection.
- b. Briefly describe (3) similar projects of comparable scope and complexity within the past ten (10) years, including project name, location, owner's name, telephone number, and point of contact, partnering experience, performance ratings, and joint venture information, if any.
- c. Provide similar information for any subcontractors to be used in this project.

Section 2: Price Proposal (NOT POINT SCORED)**Section 3: Project Management Plan**

- a. The Contractor shall provide a formal written safety program proposed for this project for the prime contractor and all major subcontractors. The program shall include a positive incentive plan with tangible rewards and benefits to individual employees during the physical construction on-site with a reward frequency of at least once a month. The name and resume of the corporate safety office and on-site safety personnel with current responsibilities and chain of command shall also be presented. Experience Modification Rate (EMR) for the past two years should also be provided.
- b. The Contractor shall show his commitment to quality control by providing a brief narrative of his quality control plan and documentation methods. The QC Plan shall address, in detail, the names, qualifications, duties, responsibilities and authority levels of each person assigned to the QC function. The QC plan shall also address

practices to ensure compliance with construction submittal requirements. The QC plan shall also demonstrate the QC office reporting directly to management and not directly responsible for project construction.

c. The subcontractors shall show their commitment to quality control by providing a brief narrative of their quality control plan and documentation methods.

d. Provide an organizational chart for this project showing home office support, on-site management and the responsible chain of command, including relationships of Joint Venture, if any. Include names of assigned personnel and all subcontractors and their areas of responsibility.

Section 4: Project Schedule

A proposed construction schedule (not more than 540 days) which clearly demonstrates understanding of the project activities, duration and sequencing of work necessary to accomplish the work in the allotted time. The Offeror may use a bar chart or similar method of his choice; however, schedule should be graphically represented so that the Contracting Officer can easily monitor progress. The successful schedule shall become the contract schedule.

Section 5: Subcontracting Plan (NOT POINT SCORED)

Provide a six-point subcontracting plan as indicated.

Section 6: Performance Capability Information

- a. Section 00610, Representations and Certifications
- b. Proof of Financial Ability (Most recent financial statement covering assets and liabilities)
- c. Other pro forma requirements indicated in Standard Form 1442 and this section
- d. Number of years firm has been in business
- e. Name, address and telephone of the firm's bank
- f. Name, address and telephone of the firm's bonding company
- g. Name, address and telephone of two credit/trade references

4. Technical Evaluation and Rating of Proposals. Offerors are advised that the technical evaluation and rating of proposals are conducted in strict confidence in that technical evaluation personnel review and rate each proposal without knowledge of the price offered. Offerors are required to segregate their cost and pricing information.

5 General Proposal Submittal Information.

a. Offerors submitting proposals for this project should limit submissions to data essential for evaluation of proposals so that a minimum of time and monies will have been expended in preparing information required herein.

b. Offerors shall certify that all items submitted in proposals comply with the requirements of the Description/Specification. The criteria specified in this RFP are binding contract criteria and in cases of any conflict, subsequent to award, between RFP criteria and contractor's submittals, the RFP criteria shall govern unless there is a

written agreement between the Contracting Officer and the contractor on the waiving of a specific requirement.

c. Clarification of the Provisions of this Request for Proposal. Any explanation desired by an offeror regarding the meaning or interpretation of the RFP shall be requested in writing and received by the Contracting Officer not later than 14 days prior to the closing date of this solicitation. Any interpretation made will be in the form of an amendment to the RFP, and will be furnished to all prospective offerors. Receipt of all amendments must be acknowledged in the space provided on the proposal form or by letter or telegram received by the time set for receipt of proposals.

SECTION 00130

EVAUATION FACTORS FOR AWARD OF OFFERS

1. STATEMENT OF WORK

The scope of this project includes construction for a new standard Qualification Training Range with a total of 28 firing lanes by modernizing the Heins, Lawly, and O'Brien Ranges. Construction will include all roadways, trails, drainage facilities, target emplacements, armor moving targets, stationary infantry targets, foxholes, firing positions, vehicle firing positions, calibration targets, complete power and data communication systems, control towers, and rear area support facilities. Support facilities include parking area, general instruction buildings, headquarters building, range support building, ammunition breakdown buildings, bleacher enclosures, covered mess, bivouac tent pads and latrines.

2. PROPOSAL EVALUATION SYSTEM

An evaluation team will be established to evaluate each proposal in response to this RFP. The technical and non-technical aspects of each proposal will be evaluated. The technical proposal, with the exception of the subcontracting plan, will be point scored. The subcontracting plan will be evaluated on a go/no-go basis. Price will be evaluated but not point scored after the technical evaluation has been completed.

The members of the evaluation team will review the proposals and score the quality of each against the evaluation factors and subfactors specified in the solicitation. Once the evaluation of the technical proposal is completed, the Government will evaluate the price proposal of each offeror and considering both technical and price may select the proposals which is the best value to the Government. If the Government determines it is necessary to conduct discussions, a competitive range will be established. Offerors are hereby notified that the competitive range may be limited for purposes of efficiency and the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

3. PROPOSAL EVALUATION CRITERIA

PRICE - The initial review of price proposals, including any options, will result in a determination of the reasonableness compared to the project requirements and the Independent Government Estimate. All evaluation factors other than cost or price, when combined, are approximately equal to cost or price.

TECHNICAL - Technical proposals will be evaluated in accordance with the following criteria, listed in relative order of importance.

1. Previous Experience
 - a. Construction of firing ranges
 - b. Similar projects
 - c. Similar projects for any subcontractors
2. Project Management Plan
 - a. Safety program
 - b. Quality control
 - c. Subcontractors quality control
 - d. Organizational chart
3. Project Schedule
4. Subcontracting Plan

3.1 Description of Proposal Evaluation Criteria. Proposals will be technically reviewed by qualified evaluators to initially determine basic conformance with the RFP, e.g., minimum acceptable compliance with applicable codes, standards and specifications. Further evaluation will establish a relative order of merit among proposals in accordance with the following:

3.1.1 Previous Experience

Evaluation and verification of data submitted with respect to previous experience will assist the Contracting Officer in making the determination as to the Offeror's responsibility. Any prospective Contractor must be found to be responsible in order to be considered for contract awards. The offeror will be evaluated based on all of the experience required by Section 00100 and 00115. Missing experience will cause the offeror to be rated lower.

Documentation of successful completion of projects similar in nature and scope and complexity to the proposed project will be favorably considered during the evaluation. Favorable consideration will also be given to offers that show successful past relationships by the prime contractor with subcontractors proposed for this project. Conversely, offers which do not include substantial evidence, satisfactory to the Contracting Officer, that Offeror has experience, and production capacity to successfully prosecute the proposed project will not be favorably considered.

The Contracting Officer may solicit and consider information from prior and current clients of offerors. Negative and positive information with respect to quality of

construction, timeliness and cost will be assessed in establishing a relative order of merit concerning past performance of all offerors. Information may be obtained from sources other than those identified by the Offeror.

3.1.2 Price.

The initial review of price proposals will result in a determination as to reasonableness compared to the independent cost estimate and funds budgeted for the project. (Also see Evaluation of Options)

3.1.3 Project Management Plan

The Offeror must demonstrate safety for this project for the prime contractor and all major subcontractors. Positive incentive plan with tangible rewards and benefits should be listed. The Offeror shall show his commitment to quality control by providing his plan and documentation methods and well as the names, qualifications, duties, responsibilities and authority levels of each person assigned to the quality control function.

3.1.4 Project Schedule

Project Schedule will be reviewed to determine reasonableness and understanding of the requirements of the RFP. A proposed 540 days schedule has been established. Offeror should clearly demonstrate understanding of the project activities, duration and sequencing of work necessary to accomplish the work within this timeframe. Bar charts or similar method should be graphically represented for easily monitoring progress.

3.1.5 Subcontracting Plan

Subcontracting Plan for Large Business: The plan will not be scored, but will be evaluated for acceptability (Go/No-Go) in accordance with AFARS 19,705.

To be acceptable, subcontracting plan must be rated 71 percent or higher under the AFARS evaluation system. Any plan that is rated 70 percent or less under the AFARS evaluation system will be carefully considered for acceptability. If discussions with Offerors are necessary, those areas where the plan is deficient will be reviewed with the Offeror with the goal of correcting deficiencies. Due to requirements for review of the successful Offerors subcontracting plan by other agencies, the Government reserves the right to negotiate the final plan with the successful Offeror before award.

3.2 Summary. Proposals will be evaluated on their own merit, independently and as objectively as possible. Subjective comparisons will be limited to those areas where it is not feasible to quantify criteria, i.e., aesthetics and certain elements of information concerning past performance. Due to the obvious and unavoidable interrelationships among evaluation criteria; however, final determination of contract award will be based on the best composite offer, all factors considered. The Government intends to award the contract on the basis of best overall value to the government, price and other factors considered which conform to the solicitation and will be most advantageous to the Government. . Government also intends to evaluate proposals and

award a contract without discussions with offerors with the exception of communications undertaken for the purpose of minor clarification; therefore, the offeror should submit the best offer possible.

4. OPENING PROPOSALS AND DISCUSSIONS

No information regarding proposals received will be furnished prior to completion of evaluation, discussion, and award of the contract.

5. NOTIFICATION OF NONSELECTION

The Government will notify all offerors not selected, advising them of the proposal which was selected. Unsuccessful offerors are invited to request in writing a debriefing meeting with Louisville District Corps of Engineers staff.

6. PRICE BASIS

Prices must be firm. Offerors will not be considered which provide for subsequent increase in price.

7. AWARD TO SINGLE OFFEROR

Subject to the provisions contained herein, award shall be to a single offeror.

8. CONTRACT AWARD

See Clause 52.215-1 Instruction to Offerors - Competitive Acquisition

9. TYPE OF CONTRACT

The Government contemplates award of a firm, fixed-price contract resulting from this solicitation.

10. EVALUATION OF OPTIONS

Except when it is determined in accordance with FAR 17.206 (b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the options.

OFFEROR: READ CAREFULLY - CHECK ALL APPLICABLE BOXES**SECTION 00610****REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFEROR
FOR NEGOTIATED CONSTRUCTION CONTRACTS****DATE OF OFFER:** _____ **DUNS NO.** _____**SOLICITATION NO.** _____ **CAGE NO.** _____**NAME AND ADDRESS OF OFFEROR:** _____

The offeror makes the following representations and certifications as part of the offer referenced above.

1. CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985) FAR 52.203-2

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory--

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision _____ [*insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization*];

(ii) As an authorized agent, does certify that the principals name in subdivision (b)(2)(i) of this provision have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) of this provision.

(c) If the offeror deletes or modifies subparagraph (a)(2) of this provision, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

2. CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991) FAR 52.203-11

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989--

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

3. TAXPAYER IDENTIFICATION (JUN 1997) FAR 52.204-3**(a) Definitions.**

"Common parent," as used in this solicitation provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Corporate status," as used in this solicitation provision, means a designation as to whether the offeror is a corporate entity, an unincorporated entity (e.g., sole proprietorship or partnership), or a corporation providing medical and health care services.

"Taxpayer Identification Number (TIN)," as used in this solicitation provision, means the number required by the IRS to be used by the offeror in reporting income tax and other returns.

(b) All offerors are required to submit the information required in paragraphs (c) through (e) of this solicitation provision in order to comply with reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M and implementing regulations issued by the Internal Revenue Service (IRS). If the resulting contract is subject to the reporting requirements described in FAR 4.903, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) Taxpayer Identification Number (TIN).

- ☐] TIN: _____
 - ☐] TIN has been applied for.
 - ☐] TIN is not required because:
 - ☐] Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the U.S. and does not have an office or place of business or a fiscal paying agency in the U.S.
 - ☐] Offeror is an agency or instrumentality of a foreign government;
 - ☐] Offeror is an agency or instrumentality of a Federal, state, or local government;
 - ☐] Other. State basis.
-

(d) Corporate Status.

- ☐] Corporation providing medical and health care services, or engaged in the billing and collecting of payments for such services;
- ☐] Other corporate entity;
- ☐] Not a corporate entity:
 - ☐] Sole proprietorship
 - ☐] Partnership
 - ☐] Hospital or extended care facility described in 26 CFR 501(c)(3) that is exempt from taxation under 26 CFR 501(a).

(e) Common Parent.

☐ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

☐ Name and TIN of Common parent:

Name _____ TIN _____
(End of provision)

4. WOMEN-OWNED BUSINESS (OCT 1995) FAR 52.204-5

(a) **Representation.** The offeror represents that it ☐ is, ☐ is not a women-owned business concern.

(b) **Definition.** "Women-owned business concern," as used in this provision, means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(End of provision)

5. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (MAR 1996) FAR 52.209-5

(a) (1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are ☐ are not ☐ presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have ☐ have not ☐, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are ☐ are not ☐ presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(ii) The Offeror has ☐ has not ☐, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

6. DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (SEP 1994) DFARS 252.209-7001

(a) Definitions.

As used in this provision--

(1) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405 (j)(i)(A)), to be a country the government of which has repeatedly provided support for acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means--

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) **Prohibition on award.** In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) **Disclosure.** If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include--

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

7. TYPE OF BUSINESS ORGANIZATION (OCT 1997) FAR 52.215-4

The offeror or respondent, by checking the applicable box, represents that--

(a) It operates as ☐ an individual, ☐ a partnership, ☐ a nonprofit organization, or ☐ a joint venture, or ☐ a corporation incorporated under the laws of the State of _____.

(b) If the offeror or respondent is a foreign entity, it operates as ☐ an individual, ☐ a partnership, ☐ a nonprofit organization, ☐ a joint venture, or ☐ a corporation, registered for business in _____.

(country)

(End of provision)

8. SMALL BUSINESS PROGRAM REPRESENTATIONS (JAN 1997) FAR 52.219-1

(a) (1) The standard industrial classification (SIC) code for this acquisition is 1629.

(2) The small business size standard is \$17.0 million.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) **Representations.** (1) The offeror represents as part of its offer that it ☐ is, ☐ is not a small business concern.

(2) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it [] is [] is not a small disadvantaged business concern.

(3) (Complete only if offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it [] is, [] is not a women-owned small business concern.

(c) **Definitions.** "Joint venture," for purposes of a small disadvantaged business (SDB) set-aside or price evaluation preference (as prescribed at 13 CFR 124.321), is a concern that is owned and controlled by one or more socially and economically disadvantaged individuals entering into a joint venture agreement with one or more business concerns and is considered to be affiliated for size purposes with such other concern(s). The combined annual receipts or employees of the concerns entering into the joint venture must meet the applicable size standard corresponding to the SIC code designated for the contract. The majority of the venture's earnings must accrue directly to the socially and economically disadvantaged individuals in the SDB concern(s) in the joint venture. The percentage of the ownership involvement in a joint venture by disadvantaged individuals must be at least 51 percent.

"Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

"Small disadvantaged business concern," as used in this provision, means a small business concern that (1) is at least 51 percent unconditionally owned by one or more individuals who are both socially and economically disadvantaged, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more socially and economically disadvantaged individuals, and (2) has its management and daily business controlled by one or more such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one or more of these entities, which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR Part 124.

"Woman-owned small business concern," as used in this provision, means a small business concern--

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) **Notice.** (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small or small disadvantaged business concern in order to obtain a contract to be awarded under the preference programs established pursuant to sections 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

- (i) Be punished by imposition of fine, imprisonment, or both;
 - (ii) Be subject to administrative remedies, including suspension and debarment; and
 - (iii) Be ineligible for participation in programs conducted under the authority of the Act.
- (End of provision)

9. SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (JAN 1997) FAR 52.219-19

(a) **Definition.** "Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the standard industrial classification code assigned to a contracting opportunity.

(b) **(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)** The Offeror [] is, [] is not an emerging small business.

(c) **(Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)** Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts - see Paragraph 11(a)(2) Small Business Program Representations).

| Number of Employees | (Construction Solicitations) Avg. Annual Gross Revenues |
|---------------------|--|
| _____ 50 or fewer | _____ \$1 million or less |
| _____ 51 - 100 | _____ \$1,000,001 - \$2 million |
| _____ 101 -250 | _____ \$2,000,001 - \$3.5 million |
| _____ 251 - 500 | _____ \$3,500,001 - \$5 million |
| _____ 501 - 750 | _____ \$5,000,001 - \$10 million |
| _____ 751 - 1,000 | _____ \$10,000,001 - \$17 million |
| _____ Over 1,000 | _____ Over \$17 million |

(End of provision)

10. SMALL DISADVANTAGED BUSINESS CONCERN REPRESENTATION (DoD CONTRACTS) (JUN 1997) DFARS 252.219-7000

(a) **Definition.** "Small disadvantaged business concern," as used in this provision, means a small business concern, owned and controlled by individuals who are both socially and economically disadvantaged, as defined by the Small Business Administration at 13 CFR Part 124, the majority of earnings of which directly accrue to such individuals. This term also means a small business concern owned and controlled by an economically disadvantaged Indian tribe or Native Hawaiian organization which meets the requirements of 13 CFR 124.112 or 13 CFR 124.113, respectively. In general, 13 CFR Part 124 describes a small disadvantaged business concern as a small business concern--

(1) Which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or

(2) In the case of any publicly owned business, at least 51 percent of the voting stock is unconditionally owned by one or more socially and economically disadvantaged individuals; and

(3) Whose management and daily business operations are controlled by one or more such individuals.

(b) **Representations.** Check the category in which your ownership falls--

_____ Subcontinent Asian (Asian-Indian) American (U.S. citizen with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal)

_____ Asian-Pacific American (U.S. citizen with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, U.S. Trust Territory of the Pacific Islands (Republic of Palau), the Northern Mariana Islands, Laos, Kampuchea (Cambodia), Taiwan, Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Republic of the Marshall Islands, the Federated States of Micronesia, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru)

_____ Black American (U.S. citizen)

_____ Hispanic American (U.S. citizen with origins from South American, Central America, Mexico, Cuba, the Dominican Republic, Puerto Rico, Spain, or Portugal)

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians, including Indian tribes or Native Hawaiian organizations)

_____ Individual/concern, other than one of the preceding, currently certified for participation in the Minority Small Business and Capital Ownership Development Program under Section 8(a) of the Small Business Act.

_____ Other

(c) Complete the following--

(1) The offeror is [] is not [] a small disadvantaged business concern.

(2) The Small Business Administration (SBA) has [] has not [] made a determination concerning the offeror's status as a small disadvantaged business concern. If the SBA has made a determination, the date of the determination was _____ and the offeror--

_____ Was found by SBA to be socially and economically disadvantaged and no circumstances have changed to vary that determination.

_____ Was found by SBA not to be socially and economically disadvantaged but circumstances which caused the determination have changed.

(d) **Penalties and Remedies.** Anyone who misrepresents the status of a concern as a small disadvantaged business for the purpose of securing a contract or subcontract shall--

- (1) Be punished by imposition of a fine, imprisonment, or both;
- (2) Be subject to administrative remedies, including suspension and debarment; and
- (3) Be ineligible for participation in programs conducted under authority of the Small Business Act.

(End of provision)

11. CERTIFICATION OF NONSEGREGATED FACILITIES (APR 1984) FAR 52.222-21

(a) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(b) By the submission of this offer, the offeror certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The offeror agrees that a breach of this certification is a violation of the Equal Opportunity clause in the contract.

(c) The offeror further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will--

- (1) Obtain identical certifications from proposed subcontractors before the award of subcontracts under which the subcontractor will be subject to the Equal Opportunity clause;
- (2) Retain the certifications in the files; and
- (3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract under which the subcontractor will be subject to the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18. U.S.C. 1001.

(End of provision)

12. PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (APR 1984) FAR 52.222-22

The offeror represents that--

(a) It [] has [] has not, participated in a previous contract or subcontract subject either to the Equal Opportunity clause of this solicitation, the clause originally contained in Section 310 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114;

(b) It [] has, [] has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

13. CLEAN AIR AND WATER CERTIFICATION (APR 1984) FAR 52.223-1

The Offeror certifies that--

(a) Any facility to be used in the performance of this proposed contract [] is, [] is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

(b) The Offeror will immediately notify the Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the EPA, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and

(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

(End of provision)

14. CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 1996) FAR 52.223-13

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facilities is exempt for at least one of the following reasons: *(Check each block that is applicable.)*

[] (i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

- [] (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);
- [] (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);
- [] (iv) The facility does not fall within the Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation; or
- [] (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(End of provision)

(End of Section 00610)

SECTION 00700
INDEX OF CONTRACT CLAUSES (CONSTRUCTION)
Issued by: Department of the Army, Corps of Engineers
Louisville District

Edition of 1 JUNE 1998

TABLE OF CONTENTS

| | |
|-----------|---|
| 1 | CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991) DFARS 252.201-7000 |
| 2 | DEFINITIONS (OCT 1995)--ALTERNATE I (APR 1984) FAR 52.202-1 I |
| 3 | GRATUITIES (APR 1984) FAR 52.203-3 |
| 4 | COVENANT AGAINST CONTINGENT FEES (APR 1984) FAR 52.203-5 |
| 5 | ANTI-KICKBACK PROCEDURES (JUL 1995) FAR 52.203-7 |
| 6 | CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-8 |
| 7 | PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-10 |
| 8 | LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997) FAR 52.203-12 |
| 9 | SPECIAL PROHIBITION ON EMPLOYMENT (NOV 1995) DFARS 252.203-7001 |
| 10 | DISPLAY OF DOD HOTLINE POSTER (DEC 1991) DFARS 252.203-7002 |
| 11 | PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996) FAR 52.204-4 |
| 12 | REQUIRED CENTRAL CONTRACTOR REGISTRATION (MAR 1998) DFARS 252.204-7004 |
| 13 | PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS (DEC 1991) DFARS 252.205-7000 |
| 14 | PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT (JUL 1995) FAR 52.209-6 |
| 15 | DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990) FAR 211-15 |
| 16 | VARIATION IN ESTIMATED QUANTITY (APR 1984) FAR 52.211-18 |
| 17 | AUDIT AND RECORDS--SEALED BIDDING (OCT 1997) FAR 52.214-26 |
| 18 | PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS--SEALED BIDDING (OCT 1997) FAR 52.214-27 |
| 19 | SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS --SEALED BIDDING (OCT 1997) FAR 52.214-28 |

- 20 **AUDIT AND RECORDS--NEGOTIATION (AUG 1996) FAR 52.215-2**
- 21 **PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA (OCT 1997)
FAR 52.215-10**
- 22 **SUBCONTRACTOR COST OR PRICING DATA (OCT 1997) FAR 52.215-12**
- 23 **TERMINATION OF DEFINED BENEFIT PENSION PLANS (OCT 1997) FAR 52.215-15**
- 24 **REVERSION OR ADJUSTMENT OF PLANS FOR POSTRETIREMENT
BENEFITS (PRB) OTHER THAN PENSIONS (OCT 1997) FAR 52.215-18**
- 25 **NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997) FAR 52.215-19**
- 26 **PRICING ADJUSTMENTS (DEC 1991) DFARS 252.215-7000**
- 27 **UTILIZATION OF SMALL, SMALL DISADVANTAGED AND WOMEN
OWNED SMALL BUSINESS CONCERNS (JUN 1997) FAR 52.219-8**
- 28 **SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL
BUSINESS SUBCONTRACTING PLAN (AUG 1996) FAR 52.219-9**
- 29 **SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL
BUSINESS SUBCONTRACTING PLAN (AUG 1996) ALTERNATE I
(OCT 1995) FAR 52.219-9 I**
- 30 **SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL
BUSINESS SUBCONTRACTING PLAN (AUG 1996) ALTERNATE II
(MAR 1996) FAR 52.219-9 II**
- 31 **LIMITATIONS ON SUBCONTRACTING (DEC 1996) FAR 52.219-14**
- 32 **LIQUIDATED DAMAGES--SUBCONTRACTING PLAN (OCT 1995) FAR 52.219-28**
- 33 **SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS
SUBCONTRACTING PLAN (DOD CONTRACTS) (APR 1996)
DFARS 252.219-7003**
- 34 **NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997) FAR 52.222-1**
- 35 **CONVICT LABOR (AUG 1996) FAR 52.222-3**
- 36 **CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME
COMPENSATION (JUL 1995) FAR 52.222-4**
- 37 **DAVIS-BACON ACT (FEB 1995) FAR 52.222-6**
- 38 **WITHHOLDING OF FUNDS (FEB 1988) FAR 52.222-7**
- 39 **PAYROLLS AND BASIC RECORDS (FEB 1988) FAR 52.222-8**
- 40 **APPRENTICES AND TRAINEES (FEB 1988) FAR 52.222-9**
- 41 **COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988) FAR 52.222-10**
- 42 **SUBCONTRACTS (LABOR STANDARDS) (FEB 1988) FAR 52.222-11**

- 43 **CONTRACT TERMINATION--DEBARMENT (FEB 1988) FAR 52.222-12**
- 44 **COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS
(FEB 1988) FAR 52.222-13**
- 45 **DISPUTES CONCERNING LABOR STANDARDS (FEB 1988) FAR 52.222-14**
- 46 **CERTIFICATION OF ELIGIBILITY (FEB 1988) FAR 52.222-15**
- 47 **EQUAL OPPORTUNITY (APR 1984) FAR 52.222-26**
- 48 **AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION
(APR 1984) FAR 52.222-27**
- 49 **AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VIETNAM ERA
(APR 1998) FAR 52.222-35**
- 50 **AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (APR 1984) FAR 52.222-36**
- 51 **EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE
VIETNAM ERA (APR 1998) FAR 52.222-37**
- 52 **CLEAN AIR AND WATER (APR 1984) FAR 52.223-2**
- 53 **POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998)
FAR 52.223-5**
- 54 **DRUG-FREE WORKPLACE (JAN 1997) FAR 52.223-6**
- 55 **OZONE-DEPLETING SUBSTANCES (JUN 1996) FAR 52.223-11**
- 56 **TOXIC CHEMICAL RELEASE REPORTING (OCT 1996) FAR 52.223-14**
- 57 **BUY-AMERICAN ACT--CONSTRUCTION MATERIALS (JUN 1997)
FAR 52.225-5**
- 58 **RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (OCT 1996) FAR 52.225-11**
- 59 **BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER EUROPEAN
COMMUNITY AND NORTH AMERICAN FREE TRADE AGREEMENTS
(JUN 1997) FAR 52.225-15**
- 60 **BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER EUROPEAN
COMMUNITY AND NORTH AMERICAN FREE TRADE AGREEMENTS
(MAY 1997) ALTERNATE I (MAY 1997) FAR 52.225-15 I**
- 61 **SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992) DFARS 252.225-7031**
- 62 **UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED
ECONOMIC ENTERPRISES (SEP 1996) FAR 52.226-1**
- 63 **AUTHORIZATION AND CONSENT (JUL 1995) FAR 52.227-1**
- 64 **PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984) FAR 52.227-4**
- 65 **RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033**

- 66 **ADDITIONAL BOND SECURITY (OCT 1997) FAR 52.228-2**
- 67 **INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997)
FAR 52.228-5**
- 68 **PLEDGES OF ASSETS (FEB 1992) FAR 52.228-11**
- 69 **PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)
FAR 52.228-12**
- 70 **FEDERAL, STATE, AND LOCAL TAXES (JAN 1991) FAR 52.229-3**
- 71 **SUPPLEMENTAL COST PRINCIPLES (DEC 1991) DFARS 252.231-7000**
- 72 **PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS
(MAY 1997) FAR 52.232-5**
- 73 **INTEREST (JUN 1996) FAR 52.232-17**
- 74 **ASSIGNMENT OF CLAIMS (JAN 1986) ALTERNATE I (APR 1984) FAR 52.232-23 I**
- 75 **PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997) FAR 52.232-27**
- 76 **PAYMENT BY ELECTRONIC FUNDS TRANSFER (CCR) (JUN 1998)
DFARS 252.232-7000**
- 77 **REDUCTION OR SUSPENSION OF CONTRACT PAYMENTS UPON
FINDING OF FRAUD (AUG 1992) DFARS 252.232-7006**
- 78 **DISPUTES (OCT 1995) 52.233-1**
- 79 **PROTEST AFTER AWARD (AUG 1996) FAR 52.233-3**
- 80 **DIFFERING SITE CONDITIONS (APR 1984) FAR 52.236-2**
- 81 **SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK
(APR 1984) FAR 52.236-3**
- 82 **MATERIAL AND WORKMANSHIP (APR 1984) FAR 52.236-5**
- 83 **SUPERINTENDENCE BY THE CONTRACTOR (APR 1984) FAR 52.236-6**
- 84 **PERMITS AND RESPONSIBILITIES (NOV 1991) FAR 52.236-7**
- 85 **OTHER CONTRACTS (APR 1984) FAR 52.236-8**
- 86 **PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT,
UTILITIES, AND IMPROVEMENTS (APR 1984) FAR 52.236-9**
- 87 **OPERATIONS AND STORAGE AREAS (APR 1984) FAR 52.236-10**
- 88 **USE AND POSSESSION PRIOR TO COMPLETION (APR 1984) FAR 52.236-11**
- 89 **CLEANING UP (APR 1984) FAR 52.236-12**
- 90 **ACCIDENT PREVENTION (NOV 1991)--ALTERNATE I (NOV 1991) FAR 52.236-13 I**

- 91 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984) FAR 52.236-15
- 92 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)
FAR 52.236-21
- 93 PRECONSTRUCTION CONFERENCE (FEB 1995) FAR 52.236-26
- 94 MODIFICATION PROPOSALS--PRICE BREAKDOWN (DEC 1991)
DFARS 252.236-7000
- 95 BANKRUPTCY (JUL 1995) FAR 52.242-13
- 96 SUSPENSION OF WORK (APR 1984) FAR 52.242-14
- 97 POSTAWARD CONFERENCE (DEC 1991) DFARS 252.242-7000
- 98 CHANGES (AUG 1987) FAR 52.243-4
- 99 PRICING OF CONTRACT MODIFICATIONS (DEC 1991) DFARS 252.243-7001
- 100 CERTIFICATION OF REQUESTS FOR EQUITABLE ADJUSTMENT (JUL 1997)
DFARS 252.243-7002
- 101 SUBCONTRACTS (FIXED-PRICE CONTRACTS) (OCT 1997) FAR 52.244-1
- 102 GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (DEC 1989) FAR 52.245-2
- 103 GOVERNMENT-FURNISHED PROPERTY (SHORT FORM) (APR 1984)
FAR 52.245-4
- 104 REPORTS OF GOVERNMENT PROPERTY (MAY 1994) DFARS 252.245-7001
- 105 INSPECTION OF CONSTRUCTION (AUG 1996) FAR 52.246-12
- 106 VALUE ENGINEERING--CONSTRUCTION (MAR 1989)
ALTERNATE I (APR 1984) FAR 52.248-3 I
- 107 TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE)
(SEP 1996)--ALTERNATE I (SEP 1996) FAR 52.249-2 I
- 108 DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984) FAR 52.249-10
- 109 COMPUTER GENERATED FORMS (JAN 1991) FAR 52.253-1

1. CONTRACTING OFFICER'S REPRESENTATIVE (DEC 1991) DFARS 252.201-7000

(a) *Definition.* "Contracting officer's representative" means an individual designated in accordance with subsection 201.602-2 of the Defense Federal Acquisition Regulation Supplement and authorized in writing by the Contracting Officer to perform specific technical or administrative functions.

(b) If the Contracting Officer designates a Contracting Officer's Representative (COR), the Contractor will receive a copy of the written designation. It will specify the extent of the COR's authority to act on behalf of the Contracting Officer. The COR is not authorized to make any commitments or changes that will affect price, quality, quantity, delivery, or any other term or condition of the contract.

(End of clause)

2. DEFINITIONS (OCT 1995)--ALTERNATE I (APR 1984) FAR 52.202-1 I

(a) "Head of the agency" (also called "agency head") or "Secretary" means the Secretary (or Attorney General, Administrator, Governor, Chairperson, or other chief official, as appropriate) of the agency, including any deputy or assistant chief official of the agency; and the term "authorized representative" means any person, persons, or board (other than the Contracting Officer) authorized to act for the head of the agency or Secretary.

(b) "Commercial component" means any component that is a commercial item.

(c) "Component" means any item supplied to the Federal Government as part of an end item or of another component.

(d) "Nondevelopmental item" means--

(1) Any previously developed item of supply used exclusively for governmental purposes by a Federal agency, a State or local government, or a foreign government with which the United States has a mutual defense cooperation agreement;

(2) Any item described in paragraph (d)(1) of this definition that requires only minor modification or modifications of a type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency; or

(3) Any item of supply being produced that does not meet the requirements of paragraph (d)(1) or (d)(2) solely because the item is not yet in use.

(e) "Contracting Officer" means a person with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the Contracting Officer acting within the limits of their authority as delegated by the Contracting Officer.

(f) Except as otherwise provided in this contract, the term "subcontracts" includes, but is not limited to, purchase orders and changes and modifications to purchase orders under this contract.

(End of clause)

3. GRATUITIES (APR 1984) FAR 52.203-3

(a) The right of the Contractor to proceed may be terminated by written notice if, after notice and hearing, the agency head or a designee determines that the Contractor, its agent, or another representative--

(1) Offered or gave a gratuity (e.g., an entertainment or gift) to an officer, official, or employee of the Government; and

(2) Intended, by the gratuity, to obtain a contract or favorable treatment under a contract.

(b) The facts supporting this determination may be reviewed by any court having lawful jurisdiction.

(c) If this contract is terminated under paragraph (a) of this clause, the Government is entitled--

(1) To pursue the same remedies as in a breach of the contract; and

(2) In addition to any other damages provided by law, to exemplary damages of not less than 3 nor more than 10 times the cost incurred by the Contractor in giving gratuities to the person concerned, as determined by the agency head or a designee. (This subparagraph (c)(2) is applicable only if this contract uses money appropriated to the Department of Defense.)

(d) The rights and remedies of the Government provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

4. COVENANT AGAINST CONTINGENT FEES (APR 1984) FAR 52.203-5

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract or any basis other than the merits of the matter.

(End of clause)

5. ANTI-KICKBACK PROCEDURES (JUL 1995) FAR 52.203-7

(a) Definitions.

"Kickback," as used in this clause, means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided, directly or indirectly, to any prime Contractor, prime Contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a subcontract relating to a prime contract.

"Person," as used in this clause, means a corporation, partnership, business association of any kind, trust, joint-stock company, or individual.

"Prime contract," as used in this clause, means a contract or contractual action entered into by the United States for the purpose of obtaining supplies, materials, equipment or services of any kind.

"Prime Contractor" as used in this clause, means a person who has entered into a prime contract with the United States.

"Prime Contractor employee," as used in this clause, means any officer, partner, employee, or agent of a prime Contractor.

"Subcontract," as used in this clause, means a contract or contractual action entered into by a prime Contractor or subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind under a prime contract.

"Subcontractor," as used in this clause, (1) means any person, other than the prime Contractor, who offers to furnish or furnishes any supplies, materials, equipment, or services of any kind under a prime contract or a subcontract entered into in connection with such prime contract, and (2) includes any person who offers to furnish or furnishes general supplies to the prime Contractor or a higher tier subcontractor.

"Subcontractor employee," as used in this clause, means any officer, partner, employee, or agent of a subcontractor.

(b) The Anti-Kickback Act of 1986 (41 U.S.C. 51-58) (the Act), prohibits any person from--

(1) Providing or attempting to provide or offering to provide any kickback;

(2) Soliciting, accepting, or attempting to accept any kickback; or

(3) Including, directly or indirectly, the amount of any kickback in the contract price charged by a prime Contractor to the United States or in the contract price charged by a subcontractor to a prime Contractor or higher tier subcontractor.

(c)(1) The Contractor shall have in place and follow reasonable procedures designed to prevent and detect possible violations described in paragraph (b) of this clause in its own operations and direct business relationships.

(2) When the Contractor has reasonable grounds to believe that a violation described in paragraph (b) of this clause may have occurred, the Contractor shall promptly report in writing the possible violation. Such reports shall be made to the inspector general of the contracting agency, the head of the contracting agency if the agency does not have an inspector general, or the Department of Justice.

(3) The Contractor shall cooperate fully with any Federal agency investigating a possible violation described in paragraph (b) of this clause.

(4) The Contracting Officer may (i) offset the amount of the kickback against any monies owed by the United States under the prime contract and/or (ii) direct that the Prime Contractor withhold from sums owed a subcontractor under the prime contract the amount of the kickback. The Contracting Officer may order that monies withheld under subdivision (c)(4)(ii) of this clause be paid to the Government unless the Government has already offset those monies under subdivision (c)(4)(i) of this clause. In either case, the Prime Contractor shall notify the Contracting Officer when the monies are withheld.

(5) The Contractor agrees to incorporate the substance of this clause, including subparagraph (c)(5) but excepting subparagraph (c)(1), in all subcontracts under this contract which exceed \$100,000.

(End of clause)

6. CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-8

(a) If the Government receives information that a contractor or a person has engaged in conduct constituting a violation of subsection (a), (b), (c), or (d) of Section 27 of the Office of Federal Procurement Policy Act (41 U.S.C. 423) (the Act), as amended by section 4304 of the 1996 National Defense Authorization Act for Fiscal Year 1996 (Pub.L. 104-106), the Government may--

(1) Cancel the solicitation, if the contract has not yet been awarded or issued; or

(2) Rescind the contract with respect to which--

(i) The Contractor or someone acting for the Contractor has been convicted for an offense where the conduct constitutes a violation of subsection 27 (a) or (b) of the Act for the purpose of either--

(A) Exchanging the information covered by such subsections for anything of value; or

(B) Obtaining or giving anyone a competitive advantage in the award of a Federal agency procurement contract; or

(ii) The head of the contracting activity has determined, based upon a preponderance of the evidence, that the Contractor or someone acting for the Contractor has engaged in conduct constituting an offense punishable under subsections 27(e) (1) of the Act.

(b) If the Government rescinds the contract under paragraph (a) of this clause, the Government is entitled to recover, in addition to any penalty prescribed by law, the amount expended under the contract.

(c) The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law, regulation, or under this contract.

(End of clause)

7. PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY (JAN 1997) FAR 52.203-10

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost-type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27(a), (b), or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation. In the case of a contract modification, the fee subject to reduction is the fee specified in the particular contract modification at the time of execution, except as provided in subparagraph (b)(5) of this clause.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be--

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract;

(3) For cost-plus-award-fee contracts--

(i) For base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may--

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract.

The total final price established in accordance with the incentive price revision provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

8. LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (JUN 1997) FAR 52.203-12

(a) *Definitions.*

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (1) The awarding of any Federal contract.
- (2) The making of any Federal grant.
- (3) The making of any Federal loan.
- (4) The entering into of any cooperative agreement.
- (5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

- (1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.
- (2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.
- (3) A special Government employee, as defined in section 202, title 18, United States Code.
- (4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual, corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means, with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

“Regularly employed,” as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

“State,” as used in this clause, means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, a territory or possession of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) *Prohibitions.*

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) *Agency and legislative liaison by own employees.*

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b)(3)(i)(A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person’s products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person’s products or services for an agency’s use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action--

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b)(3)(i)(A) of this clause are permitted under this clause.

(ii) *Professional and technical services.*

(A) The prohibition on the use of appropriated funds, in subparagraph (b)(1) of this clause, does not apply in the case of--

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal

action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

- (2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.
- (B) For purposes of subdivision (b)(3)(ii)(A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance of operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly and solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not provide legal advice or analysis directly and solely related to the legal aspects of this or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.
- (C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.
- (D) Only those services expressly authorized by subdivisions (b)(3)(ii)(A)(1) and (2) of this clause are permitted under this clause.
- (E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) *Disclosure.*

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b)(1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c)(1) of this clause. An event that materially affects the accuracy of the information reported includes--

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing are attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempting to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or receives any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the

calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontract file of the awarding Contractor.

(d) *Agreement.* The Contractor agrees not to make any payment prohibited by this clause.

(e) *Penalties.*

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) *Cost allowability.* Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely, costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of clause)

9. SPECIAL PROHIBITION ON EMPLOYMENT (NOV 1995) DFARS 252.203-7001

(a) *Definitions.* As used in this clause--

(1) "Arising out of a contract with the DoD" means any act in connection with--

(i) Attempting to obtain,

(ii) Obtaining, or

(iii) Performing a contract or first-tier subcontract of any agency, department, or component of the Department of Defense (DoD).

(2) "Conviction of fraud or any other felony" means any conviction for fraud or a felony in violation of state or Federal criminal statutes, whether entered on a verdict or plea, including a plea of *nolo contendere*, for which sentence has been imposed.

(3) "Date of conviction" means the date judgment was entered against the individual.

(b) 10 U.S.C. 2408 provides that any individual who is convicted after September 29, 1988, of fraud or any other felony arising out of a contract with the DoD is prohibited from:

(1) Working in a management or supervisory capacity on any DoD contract or first-tier subcontract;

(2) Serving on the board of directors of any DoD contractor or first-tier subcontractor; or

(3) Serving as a consultant to any DoD contractor or first-tier subcontractor.

(c) Unless waived, the prohibition in paragraph (b) applies for five years from the date of conviction.

(d) 10 U.S.C. 2408 further provides that a defense contractor or first-tier subcontractor shall be subject to a criminal penalty of not more than \$500,000 if convicted of knowingly--

(1) Employing a person under a prohibition specified in paragraph (b) of this clause; or

(2) Allowing such a person to serve on the board of directors of the contractor or first-tier subcontractor.

(e) In addition to the criminal penalties contained in 10 U.S.C. 2408, the Government may consider other available remedies, such as--

(1) Suspension or debarment;

(2) Cancellation of the contract at no cost to the Government; or

(3) Termination of the contract for default.

(f) The Contractor may submit written requests for waiver of the prohibitions in paragraph (b) of this clause to the Contracting Officer. Requests shall clearly identify--

(1) The person involved;

(2) The nature of the conviction and resultant sentence or punishment imposed;

(3) The reasons for the requested waiver, and

(4) An explanation of why a waiver is in the interest of national security.

(g) The Contractor agrees to include the substance of this clause, appropriately modified to reflect the identity and relationship of the parties, in all first-tier subcontracts exceeding the simplified acquisition threshold in part 13 of the Federal Acquisition Regulation, except those for commercial items or components.

(h) Pursuant to 10 U.S.C. 2408(c), defense contractors and subcontractors may obtain information as to whether a particular person has been convicted of fraud or any other felony arising out of a contract with the DoD by contacting The Office of Justice Programs, The Denial of Benefits Office, U.S. Department of Justice, telephone (202) 307-1065.

(End of clause)

10. DISPLAY OF DOD HOTLINE POSTER (DEC 1991) DFARS 252.203-7002

(a) The Contractor shall display prominently in common work areas within business segments performing work under Department of Defense (DoD) contracts, DoD Hotline Posters prepared by the DoD Office of the Inspector General.

(b) DoD Hotline Posters may be obtained from the DoD Inspector General, ATTN: Defense Hotline, 400 Army Navy Drive, Washington, DC 22202-2884.

(c) The Contractor need not comply with paragraph (a) of this clause if it has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of clause)

**11. PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER (JUN 1996)
FAR 52.204-4**

(a) In accordance with Executive Order 12873, dated October 20, 1993, as amended by Executive Order 12995, dated March 25, 1996, the Offeror/Contractor is encouraged to submit paper documents, such as offers, letters, or reports, that are printed/copied double-sided on recycled paper that has at least 20 percent postconsumer material.

(b) The 20 percent standard applies to high-speed copier paper offset paper, forms bond, computer printout paper, carbonless paper, file folders, white woven envelopes, and other uncoated printed and writing paper such as writing and office paper, book paper, cotton fiber paper, and cover stock. An alternative to meeting the 20 percent postconsumer material standards is 50 percent recovered material content of certain industrial by-products.

(End of clause)

**12. REQUIRED CENTRAL CONTRACTOR REGISTRATION (MAR 1998)
DFARS 52.204-7004**

(a) Definitions. As used in this clause—

(1) Central Contractor Registration (CCR) database means the primary DoD repository for contractor information required for the conduct of business with DoD.

(2) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.

(3) Data Universal Numbering System+4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.

(4) Registered in the CCR database means that all mandatory information including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b) (1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during the performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offer ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at <http://ccr.edi.disa.mil>.

(End of clause)

**13. PROVISION OF INFORMATION TO COOPERATIVE AGREEMENT HOLDERS
(DEC 1991) DFARS 252.205-7000**

(a) *Definition.*

“Cooperative agreement holder” means a State or local government; a private, nonprofit organization; a tribal organization (as defined in section 4(c) of the Indian Self-Determination and Education Assistance Act (Pub. L. 93-268; 25 U.S.C. 450(c)); or an economic enterprise (as defined in section 3(e) of the Indian Financing Act of 1974 (Pub. L. 93-362; 25 U.S.C. 1452(e)) whether such economic enterprise is organized for profit or nonprofit purposes; which has an agreement with the Defense Logistics Agency to furnish procurement technical assistance to business entities.

(b) The Contractor shall provide cooperative agreement holders, upon their request, with a list of those appropriate employees or offices responsible for entering into subcontracts under defense contracts. The list shall include the business address, telephone number, and area of responsibility of each employee or office.

(c) The Contractor need not provide the listing to a particular cooperative agreement holder more frequently than once a year.

(End of clause)

**14. PROTECTING THE GOVERNMENT’S INTEREST WHEN SUBCONTRACTING WITH
CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT
(JUL 1995) FAR 52.209-6**

(a) The Government suspends or debar Contractors to protect the Government’s interests. The Contractor shall not enter into any subcontract in excess of \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor’s knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

(3) The compelling reasons(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government’s interest when dealing with such subcontractor in view of the specific basis for the party’s debarment, suspension, or proposed debarment.

(End of clause)

**15. DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS (SEP 1990)
FAR 52.211-15**

NOTE: This clause applies only to military contracts.

This is a rated order certified for national defense use, and the contractor shall follow all the requirements of the Defense Priorities and Allocations System regulation (15 CFR 700).

(End of clause)

16. VARIATION IN ESTIMATED QUANTITY (APR 1984) FAR 52.211-18

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due

solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgment of the Contracting Officer, is justified.

(End of clause)

17. AUDIT AND RECORDS--SEALED BIDDING (OCT 1997) FAR 52.214-26

NOTE: This clause applies only to sealed bid contracts.

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) *Cost or pricing data.* If the Contractor has been required to submit cost or pricing data in connection with the pricing of any modification to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

- (1) The proposal for the modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the modification; or
- (4) Performance of the modification.

(c) *Comptroller General.* In the case of pricing any modification, the Comptroller General of the United States, or an authorized representative, shall have the same rights as specified in paragraph (b) of this clause.

(d) *Availability.* The Contractor shall make available at its office at all reasonable times the materials described in paragraph (b) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any other period specified in Subpart 4.7 of the Federal Acquisition Regulation (FAR). FAR Subpart 4.7, Contractor Records Retention, in effect on the date of this contract, is incorporated by reference in its entirety and made a part of this contract.

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement.

(2) Records pertaining to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to the performance of this contract shall be made available until disposition of such appeals, litigation, or claims.

(e) The Contractor shall insert a clause containing all the provisions of this clause, including this paragraph (e), in all subcontracts expected to exceed the threshold in FAR 15.403-4(a)(1) for submission of cost or pricing data.

(End of clause)

18. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA--MODIFICATIONS--SEALED BIDDING (OCT 1997) FAR 52.214-27

NOTE: This clause applies only to sealed bid contracts.

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.403-4(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.403-1(b) applies.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) of this clause.

(c) Any reduction in the contract price under paragraph (b) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d)(1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (d)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

- (A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and
- (B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if--

- (A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or
- (B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data has been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621 (a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

19. SUBCONTRACTOR COST OR PRICING DATA--MODIFICATIONS-SEALED BIDDING (OCT 1997) FAR 52.214-28

NOTE: This clause applies only to sealed bid contracts.

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specified identification in writing), unless an exception under FAR 15.403-1(b) applies.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection FAR 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (b) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.403-4(a)(1).

(End of clause)

20. AUDIT AND RECORDS--NEGOTIATION (AUG 1996) FAR 52.215-2

NOTE: This clause applies only to negotiated contracts.

(a) As used in this clause, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form.

(b) *Examination of costs.* If this is a cost-reimbursement, incentive, time-and-materials, labor-hour, or price redeterminable contract, or any combination of these, the Contractor shall maintain and the Contracting Officer, or an authorized representative of the Contracting Officer, shall have the right to examine and audit all records and other evidence sufficient to reflect properly all costs claimed to have been incurred or anticipated to be incurred directly or indirectly in performance of this contract. This right of examination shall include inspection at all reasonable times of the Contractor's plants, or parts of them, engaged in performing the contract.

(c) *Cost or pricing data.* If the Contractor has been required to submit cost or pricing data in connection with any pricing action relating to this contract, the Contracting Officer, or an authorized representative of the Contracting Officer, in order to evaluate the accuracy, completeness, and currency of the cost or pricing data, shall have the right to examine and audit all of the Contractor's records, including computations and projections, related to--

- (1) The proposal for the contract, subcontract, or modification;
- (2) The discussions conducted on the proposal(s), including those related to negotiating;
- (3) Pricing of the contract, subcontract, or modification; or
- (4) Performance of the contract, subcontract or modification.

(d) *Comptroller General.*--(1) The Comptroller General of the United States, or an authorized representative, shall have access to and the right to examine any of the Contractor's directly pertinent records involving transactions related to this contract or a subcontract hereunder.

(2) This paragraph may not be construed to require the Contractor or subcontractor to create or maintain any record that the Contractor or subcontractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) *Reports.* If the Contractor is required to furnish cost, funding, or performance reports, the Contracting Officer or an authorized representative of the Contracting Officer shall have the right to examine and audit the supporting records and materials, for the purpose of evaluating (1) the effectiveness of the Contractor's policies and procedures to produce data compatible with the objectives of these reports and (2) the data reported.

(f) *Availability.* The Contractor shall make available at its office at all reasonable times the records, materials, and other evidence described in paragraphs (a), (b), (c), (d), and (e) of this clause, for examination, audit, or reproduction, until 3 years after final payment under this contract, or for any shorter period specified in Subpart 4.7, Contractor Records Retention, of the Federal Acquisition Regulation (FAR), or for any longer period required by statute or by other clauses of this contract. In addition--

(1) If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement; and

(2) Records relating to appeals under the Disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(g) The Contractor shall insert a clause containing all the terms of this clause, including this paragraph (g), in all subcontracts under this contract that exceed the simplified acquisition threshold, and--

- (1) That are cost-reimbursement, incentive, time-and-materials, labor-hour, or price-redeterminable type or any combination of these;
- (2) For which cost or pricing data are required; or
- (3) That require the subcontractor to furnish reports as discussed in paragraph (c) of this clause.

The clause may be altered only as necessary to identify properly the contracting parties and the Contracting Officer under the Government prime contract.

(End of clause)

21. PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA (OCT 1997) FAR 52.215-10

NOTE: This clause applies only to negotiated contracts.

(a) If any price, including profit or fee, negotiated in connection with this contract, or any cost reimbursable under this contract, was increased by any significant amount because --(1) The Contractor or a subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data; (2) A subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in the Contractor's Certificate of Current Cost or Pricing Data, or (3) Any of these parties furnished data of any description that were not accurate, the price or cost shall be reduced accordingly and the contract shall be modified to reflect the reduction.

(b) Any reduction in the contract price under paragraph (a) of this clause due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus applicable overhead and profit markup, by which (1) The actual subcontract; or (2) The actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(c)(1) If the Contracting Officer determines under paragraph (a) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense:

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract.

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2)(i) Except as prohibited by subdivision (c)(2)(ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if--

- (A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and
- (B) The Contractor proves that the cost or pricing data were available before the "as of" date specified on its Certificate of Current Cost or Pricing Data, and that the data were not submitted before such date

(ii) An offset shall not be allowed if--

- (A) The understated data was known by the Contractor to be understated before the "as of" date specified on its Certificate of Current Cost or Pricing Data; or
- (B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data has been submitted before the "as of" date specified on its Certificate of Current Cost or Pricing Data.

(d) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid--

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable under payment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of clause)

22. SUBCONTRACTOR COST OR PRICING DATA (OCT 1997) FAR 52.215-12

NOTE: This clause applies only to negotiated contracts.

(a) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.403-4, on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modification involving a pricing adjustment expected to exceed the threshold for submission of cost or pricing data at FAR

15.403-4, the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.403-1 applies.

(b) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection 15.406-2 that, to the best of its knowledge and belief, the data submitted under paragraph (a) of this clause were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(c) In each subcontract that exceeds the threshold for submission of cost or pricing data at FAR 15.403-4, when entered into, the Contractor shall insert either--

(1) The substance of this clause, including this paragraph (c), if paragraph (a) of this clause requires submission of cost or pricing data for the subcontract; or

(2) The substance of the clause at FAR 52.215-13, Subcontractor Cost or Pricing Data--Modifications.

(End of clause)

23. TERMINATION OF DEFINED BENEFIT PENSION PLANS (OCT 1997) FAR 52.215-15

NOTE: This clause applies only to negotiated contracts.

The Contractor shall promptly notify the Contracting Officer in writing when it determines that it will terminate a defined benefit pension plan or otherwise recapture such pension fund assets. If pension fund assets revert to the Contractor or are constructively received by it under a termination or otherwise, the Contractor shall make a refund or give a credit to the Government for its equitable share as required by FAR 31.205-6(j)(4). The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirements of FAR 15.408(g).

(End of clause)

24. REVERSION OR ADJUSTMENT OF PLANS FOR POSTRETIREMENT BENEFITS (PRB) OTHER THAN PENSIONS (OCT 1997) FAR 52.215-18

NOTE: This clause applies only to negotiated contracts.

The Contractor shall promptly notify the Contracting Officer in writing when it determines that it will terminate or reduce a PRB plan. If PRB fund assets revert, or inure, to the Contractor or are constructively received by it under a plan termination or otherwise, the Contractor shall make a refund or give a credit to the Government for its equitable share as required by FAR 31.205-6(o)(6). The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirements of FAR 15.408(j)

(End of clause)

25. NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997) FAR 52.215-19

NOTE: This clause applies only to negotiated contracts.

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, which could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall-- (1) Maintain current, accurate, and complete inventory records of assets and their costs; (2) Provide the ACO or designated representative ready access to the records upon request; (3) Ensure that all individual and grouped assets, their capitalized values, accumulated depreciation or amortization, and remaining useful lives are identified accurately before and after each of the Contractor's ownership changes; and (4) Retain and continue to maintain depreciation and amortization schedules based on the asset records maintained before each Contractor ownership change.

(c) The Contractor shall include the substance of this clause in all subcontracts under this contract which meet the applicability requirement of FAR 15.408(k).

(End of clause)

26. PRICING ADJUSTMENTS (DEC 1991) DFARS 252.215-7000

NOTE: This clause applies only to negotiated contracts.

The term "pricing adjustment," as used in paragraph (a) of the clauses entitled "Price Reduction for Defective Cost or Pricing Data - Modifications," "Subcontractor Cost or Pricing Data," and "Subcontractor Cost or Pricing Data - Modifications," means the aggregate increases and/or decreases in cost plus applicable profits.

(End of clause)

27. UTILIZATION OF SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS CONCERNS (JUN 1997) FAR 52.219-8

(a) It is the policy of the United States that small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women shall have the maximum practicable opportunity to participate in performing contracts let by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns, small business concerns owned and controlled by socially and economically disadvantaged individuals and small business concerns owned and controlled by women.

(b) The Contractor hereby agrees to carry out this policy in the awarding of subcontracts to the fullest extent consistent with efficient contract performance. The Contractor further agrees to cooperate in any studies or surveys as may be conducted by the United States Small Business Administration or the awarding agency of the United States as may be necessary to determine the extent of the Contractor's compliance with this clause.

(c) As used in this contract, the term "small business concern" shall mean a small business as defined pursuant to section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto. The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern (1) which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or, in the case of any publicly owned business, at least 51 percent of the stock of which is unconditionally owned by one or more socially and economically disadvantaged individuals; and (2) whose management and daily business operations are controlled by one or more of such individuals. This term also means a small business concern that is at least 51 percent unconditionally owned by an economically disadvantaged Indian tribe or Native Hawaiian Organization, or a publicly owned business having at least 51 percent of its stock unconditionally owned by one of these entities which has its management and daily business controlled by members of an economically disadvantaged Indian tribe or Native Hawaiian Organization, and which meets the requirements of 13 CFR 124. The Contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Subcontinent Asian Americans, and other minorities, or any other individual found to be disadvantaged by the Administration pursuant to section 8(a) of the Small Business Act. The Contractor shall presume that socially and economically disadvantaged entities also include Indian Tribes and Native Hawaiian Organizations.

(d) The term "small business concern owned and controlled by women" shall mean a small business concern (1) which is at least 51 percent owned by one or more women, or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women, and (2) whose management and daily business operations are controlled by one or more women; and

(e) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern, a small business concern owned and controlled by socially and economically disadvantaged individuals or a small business concern owned and controlled by women.

(End of clause)

28. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (AUG 1996) FAR 52.219-9

NOTE: This clause applies to negotiated solicitations over \$1,000,000.00. See also FAR 52.219-9 II below

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

“Subcontract,” as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The offeror, upon request by the Contracting Officer, shall submit and negotiate a subcontracting plan, where applicable, which separately addresses subcontracting with small business concerns, with small disadvantaged business concerns and with women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns, and women-owned small business concerns with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate the subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror’s subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the methods used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research and Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern’s size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror’s subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurance that the offeror will include the clause in this contract entitled “Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns” in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and non-commercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

**29. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS
SUBCONTRACTING PLAN (AUG 1996) ALTERNATE I (OCT 1995) FAR 52.219-9 I**

NOTE: This clause applies only to sealed-bid solicitations over \$1,000,000.00.

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) The apparent low bidder, upon request by the Contracting Officer, shall submit a subcontracting plan, where applicable, which separately addresses subcontracting with small business concerns, with small disadvantaged business concerns and with women-owned small business concerns. If the bidder is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns, and women-owned small business concerns, with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be submitted within the time specified by the Contracting Officer. Failure to submit the subcontracting plan shall make the bidder ineligible for the award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the methods used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurance that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295, Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its

efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and non-commercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

**30. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS
SUBCONTRACTING PLAN (AUG 1996) ALTERNATE II (MAR 1996)
FAR 52.219-9 II**

NOTE: This clause applies only to negotiated solicitations over \$1,000,000, when a subcontracting plan is required with the initial proposal as described in Sections 00110 & 00115.

(a) This clause does not apply to small business concerns.

(b) "Commercial product," as used in this clause, means a product in regular production that is sold in substantial quantities to the general public and/or industry at established catalog or market prices. It also means a product which, in the opinion of the Contracting Officer, differs only insignificantly from the Contractor's commercial product.

"Subcontract," as used in this clause, means any agreement (other than one involving an employer-employee relationship) entered into by a Federal Government prime Contractor or subcontractor calling for supplies or services required for performance of the contract or subcontract.

(c) Proposals submitted in response to this solicitation shall include a subcontracting plan, which separately addresses subcontracting with small business concerns, small disadvantaged business concerns and women-owned small business concerns. If the offeror is submitting an individual contract plan, the plan must separately address subcontracting with small business concerns, small disadvantaged business concerns and women-owned small business concerns with a separate part for the basic contract and separate parts for each option (if any). The plan shall be included in and made a part of the resultant contract. The subcontracting plan shall be negotiated within the time specified by the Contracting Officer. Failure to submit and negotiate a subcontracting plan shall make the offeror ineligible for award of a contract.

(d) The offeror's subcontracting plan shall include the following:

(1) Goals, expressed in terms of percentages of total planned subcontracting dollars, for the use of small business concerns, small disadvantaged business concerns and women-owned small business concerns as subcontractors. The offeror shall include all subcontracts that contribute to contract performance, and may include a proportionate share of products and services that are normally allocated as indirect costs.

(2) A statement of--

(i) Total dollars planned to be subcontracted;

(ii) Total dollars planned to be subcontracted to small business concerns;

(iii) Total dollars planned to be subcontracted to small disadvantaged business concerns; and

(iv) Total dollars planned to be subcontracted to women-owned small business concerns.

(3) A description of the principal types of supplies and services to be subcontracted, and an identification of the types planned for subcontracting to (i) small business concerns, (ii) small disadvantaged business concerns and (iii) women-owned small business concerns.

(4) A description of the method used to develop the subcontracting goals in paragraph (d)(1) of this clause.

(5) A description of the methods used to identify potential sources for solicitation purposes (e.g., existing company source lists, the Procurement Automated Source System (PASS) of the Small Business Administration, the National Minority Purchasing Council Vendor Information Service, the Research Information Division of the Minority Business Development Agency in the Department of Commerce, or small, small disadvantaged and women-owned small business concerns trade associations). A firm may rely on the information contained in PASS as an accurate representation of a concern's size and ownership characteristics for purposes of maintaining a small business source list. A firm may rely on PASS as its small business source list. Use of the PASS as its source list does not relieve a firm of its responsibilities (e.g., outreach, assistance, counseling, publicizing subcontracting opportunities) in this clause.

(6) A statement as to whether or not the offeror included indirect costs in establishing subcontracting goals, and a description of the method used to determine the proportionate share of indirect costs to be incurred with (i) small business concerns, (ii) small disadvantaged business concerns, and (iii) women-owned small business concerns.

(7) The name of the individual employed by the offeror who will administer the offeror's subcontracting program, and a description of the duties of the individual.

(8) A description of the efforts the offeror will make to assure that small, small disadvantaged and women-owned small business concerns have an equitable opportunity to compete for subcontracts.

(9) Assurance that the offeror will include the clause in this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and that the offeror will require all subcontractors (except small business concerns) who receive subcontracts in excess of \$500,000 (\$1,000,000 for construction of any public facility) to adopt a plan similar to the plan agreed to by the offeror.

(10) Assurances that the offeror will (i) cooperate in any studies or surveys as may be required, (ii) submit periodic reports in order to allow the Government to determine the extent of compliance by the offeror with the subcontracting plan, (iii) submit Standard Form (SF) 294, Subcontracting Report for Individual Contracts, and/or SF 295,

Summary Subcontract Report, in accordance with the instructions on the forms, and (iv) ensure that its subcontractors agree to submit Standard Forms 294 and 295.

(11) A recitation of the types of records the offeror will maintain to demonstrate procedures that have been adopted to comply with the requirements and goals in the plan, including establishing source lists; and a description of its efforts to locate small, small disadvantaged and women-owned small business concerns and award subcontracts to them. The records shall include at least the following (on a plant-wide or company-wide basis, unless otherwise indicated):

(i) Source lists (e.g., PASS), guides, and other data that identify small, small disadvantaged and women-owned small business concerns.

(ii) Organizations contacted in an attempt to locate sources that are small, small disadvantaged or women-owned small business concerns.

(iii) Records on each subcontract solicitation resulting in an award of more than \$100,000, indicating (A) whether small business concerns were solicited and if not, why not, (B) whether small disadvantaged business concerns were solicited and if not, why not, (C) whether women-owned small business concerns were solicited and if not, why not, and (D) if applicable, the reason award was not made to a small business concern.

(iv) Records of any outreach efforts to contact (A) trade associations, (B) business development organizations, and (C) conferences and trade fairs to locate small, small disadvantaged and women-owned small business sources.

(v) Records of internal guidance and encouragement provided to buyers through (A) workshops, seminars, training, etc., and (B) monitoring performance to evaluate compliance with the program's requirements.

(vi) On a contract-by-contract basis, records to support award data submitted by the offeror to the Government, including the name, address, and business size of each subcontractor. Contractors having company or division-wide annual plans need not comply with this requirement.

(e) In order to effectively implement this plan to the extent consistent with efficient contract performance, the Contractor shall perform the following functions:

(1) Assist small, small disadvantaged and women-owned small business concerns by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation by such concerns. Where the contractor's lists of potential small, small disadvantaged and women-owned small business subcontractors are excessively long, reasonable effort shall be made to give all such small business concerns an opportunity to compete over a period of time.

(2) Provide adequate and timely consideration of the potentialities of small, small disadvantaged and women-owned small business concerns in all "make-or-buy" decisions.

(3) Counsel and discuss subcontracting opportunities with representative of small, small disadvantaged and women-owned small business firms.

(4) Provide notice to subcontractors concerning penalties and remedies for misrepresentations of business status as small, small disadvantaged or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the Contractor's subcontracting plan.

(f) A master subcontracting plan on a plant or division-wide basis which contains all the elements required by (d) above, except goals, may be incorporated by reference as a part of the subcontracting plan required of the offeror by this clause; provided, (1) the master plan has been approved, (2) the offeror ensures that the master plan is updated as necessary and provides copies of the approved master plan, including evidence of its approval, to the Contracting Officer, and (3) goals and any deviations from the master plan deemed necessary by the Contracting Officer to satisfy the requirements of this contract are set forth in the individual subcontracting plan.

(g)(1) If a commercial product is offered, the subcontracting plan required by this clause may relate to the offeror's production generally, for both commercial and non-commercial products, rather than solely to the Government contract. In these cases, the offeror shall, with the concurrence of the Contracting Officer, submit one company-wide or division-wide annual plan.

(2) The annual plan shall be reviewed for approval by the agency awarding the offeror its first prime contract requiring a subcontracting plan during the fiscal year, or by an agency satisfactory to the Contracting Officer.

(3) The approved plan shall remain in effect during the offeror's fiscal year for all of the offeror's commercial products.

(h) Prior compliance of the offeror with other such subcontracting plans under previous contracts will be considered by the Contracting Officer in determining the responsibility of the offeror for award of the contract.

(i) The failure of the Contractor or subcontractor to comply in good faith with (1) the clause of this contract entitled "Utilization of Small, Small Disadvantaged and Women-Owned Small Business Concerns," or (2) an approved plan required by this clause, shall be a material breach of the contract.

(End of clause)

31. LIMITATIONS ON SUBCONTRACTING (DEC 1996) FAR 52.219-14

NOTE: This clause applies only if the contract, or any portion of the contract is set-aside for small business or set-aside for the 8(a) program.

- (a) This clause does not apply to the unrestricted portion of a partial set-aside.
 - (b) By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for--
 - (1) *Services (except construction)*. At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.
 - (2) *Supplies (other than procurement from a nonmanufacturer of such supplies)*. The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.
 - (3) *General construction*. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.
 - (4) *Construction by special trade contractors*. The concern will perform at least 25 percent of the cost of the contract, not including the cost of materials, with its own employees.
- (End of clause)

32. LIQUIDATED DAMAGES--SUBCONTRACTING PLAN (OCT 1995) FAR 52.219-16

- (a) "Failure to make a good faith effort to comply with the subcontracting plan", as used in this clause, means a willful or intentional failure to perform in accordance with the requirements of the subcontracting plan approved under the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," or willful or intentional action to frustrate the plan.
 - (b) If, at contract completion, or in the case of a commercial product plan, at the close of the fiscal year for which the plan is applicable, the Contractor has failed to meet its subcontracting goals and the Contracting Officer decides in accordance with paragraph (c) of this clause that the Contractor failed to make a good faith effort to comply with its subcontracting plan, established in accordance with the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contractor shall pay the Government liquidated damages in an amount stated. The amount of probable damages attributable to the Contractor's failure to comply, shall be an amount equal to the actual dollar amount by which the Contractor failed to achieve each subcontract goal or, in the case of a commercial products plan, that portion of the dollar amount allocable to Government contracts by which the Contractor failed to achieve each subcontract goal.
 - (c) Before the Contracting Officer makes a final decision that the Contractor has failed to make such good faith effort, the Contracting Officer shall give the Contractor written notice specifying the failure and permitting the Contractor to demonstrate what good faith efforts have been made. Failure to respond to the notice may be taken as an admission that no valid explanation exists. If, after consideration of all pertinent data, the Contracting Officer finds that the Contractor failed to make a good faith effort to comply with the subcontracting plan, the Contracting Officer shall issue a final decision to that effect and require that the Contractor pay the Government liquidated damages as provided in paragraph (b) of this clause.
 - (d) With respect to commercial product plans; i.e., company-wide or division-wide subcontracting plans approved under paragraph (g) of the clause in this contract entitled "Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan," the Contracting Officer of the agency that originally approved the plan will exercise the functions of the Contracting Officer under this clause on behalf of all agencies that awarded contracts covered by that commercial product plan.
 - (e) The Contractor shall have the right of appeal, under the clause in this contract entitled, Disputes, from any final decision of the Contracting Officer.
 - (f) Liquidated damages shall be in addition to any other remedies that the Government may have.
- (End of clause)

33. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN (DoD CONTRACTS) (APR 1996) DFARS 252.219-7003

This clause supplements the Federal Acquisition Regulation 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan, clause of this contract.

(a) *Definitions.*

“Historically black colleges and universities,” as used in this clause, means institutions determined by the Secretary of Education to meet the requirements of 34 CFR Section 608.2. The term also means any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

“Minority institutions,” as used in this clause, means institutions meeting the requirement of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1135d-5(3)). The term also includes Hispanic-serving institutions as defined in Section 316(b)(1) of such Act (20 U.S.C. 1059c(b)(1)).

(b) Except for company or division-wide commercial items subcontracting plans, the term “small disadvantaged business,” when used in the FAR 52.219-9 clause, includes historically black colleges and universities and minority institutions, in addition to small disadvantaged business concerns.

(c) Work under the contract or its subcontracts shall be credited toward meeting the small disadvantaged business concern goal required by paragraph (d) of the FAR 52.219-9 clause when:

- (1) It is performed on Indian lands or in joint venture with an Indian tribe or a tribally-owned corporation, and
- (2) It meets the requirements of 10 U.S.C. 2323a.

(d) Subcontracts awarded to workshops approved by the Committee for Purchase from People Who are Blind or Severely Disabled (41 U.S.C. 46-48), may be counted toward the Contractor’s small business subcontracting goal.

(e) A mentor firm, under the Pilot Mentor-Protégé Program established under Section 831 of Pub. L. 101-510, as amended, may count toward its small disadvantaged business goal, subcontracts awarded--

- (1) Protégé firms which are qualified organizations employing the severely handicapped; and
- (2) Former protégé firms that meet the criteria in Section 831(g)(4) of Pub. L. 101-510.

(f) The master plan approval referred to in paragraph (f) of the FAR 52.219-9 clause is approval by the Contractor’s cognizant contract administration activity.

(g) In those subcontracting plans which specifically identify small, small disadvantaged, and women-owned small businesses, the Contractor shall notify the Administrative Contracting Officer of any substitutions of firms that are not small, small disadvantaged, or women-owned small businesses for the firms listed in the subcontracting plan. Notifications shall be in writing and shall occur within a reasonable period of time after award of the subcontract. Contractor-specified formats shall be acceptable.

(End of clause)

34. NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997) FAR 52.222-1

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

(End of clause)

35 CONVICT LABOR (AUG 1996) FAR 52.222-3

The Contractor agrees not to employ in the performance of this contract any person undergoing a sentence of imprisonment which has been imposed by any court of a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands. This limitation, however, shall not prohibit the employment by the Contractor in the performance of this contract of persons on parole or probation to work at paid employment during the term of their sentence or persons who have been pardoned or who have served their terms. Nor shall it prohibit the employment by the Contractor in the performance of this contract of persons confined for violation of the laws of any of the States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, or the Trust Territory of the Pacific Islands who are authorized to work at paid employment in the community under the laws of such jurisdiction, if--

- (a) (1) The worker is paid or is in an approved work training program on a voluntary basis;
- (2) Representatives of local union central bodies or similar labor union organizations have been consulted;
- (3) Such paid employment will not result in the displacement of employed workers, or be applied in skills, crafts, or trades in which there is a surplus of available gainful labor in the locality, or impair existing contracts for services;
- (4) The rates of pay and other conditions of employment will not be less than those paid or provided for work of a similar nature in the locality in which the work is being performed; and

(b) The Attorney General of the United States has certified that the work-release laws or regulations of the jurisdiction involved are in conformity with the requirements of Executive Order 11755, as amended by Executive Orders 12608 and 12943.

(End of clause)

**36. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME
COMPENSATION (JUL 1995) FAR 52.222-4**

(a) *Overtime requirements.* No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics (see Federal Acquisition Regulation (FAR) 22.300) shall require or permit any such laborers or mechanics in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1-1/2 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(b) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the provisions set forth in paragraph (a) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanical employed in violation of the provisions set forth in paragraph (a) of this clause in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in paragraph (a) of this clause.

(c) *Withholding for unpaid wages and liquidated damages.* The Contracting Officer shall upon his or her own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same Prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same Prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in paragraph (b) of this clause.

(d) *Payrolls and basic records.* (1) The Contractor or subcontractor shall maintain payrolls and basic payroll records during the course of contract work and shall preserve them for a period of 3 years from the completion of the contract for all laborers and mechanics working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Nothing in this paragraph shall require the duplication of records required to be maintained for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The records to be maintained under paragraph (d)(1) of this clause shall be made available by the Contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit such representatives to interview employees during working hours on the job.

(e) *Subcontracts.* The Contractor or subcontractor shall insert in any subcontracts exceeding \$100,000 the provisions set forth in paragraphs (a) through (e) of this clause and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the provisions set forth in paragraphs (a) through (e) of this clause.

(End of clause)

37. DAVIS-BACON ACT (FEB 1995) FAR 52.222-6

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly

period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approved an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b)(2) and (b)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of clause)

38. WITHHOLDING OF FUNDS (FEB 1988) FAR 52.222-7

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer

or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of clause)

39. PAYROLLS AND BASIC RECORDS (FEB 1988) FAR 52.222-8

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents. U.S. Government Printing Office, Washington, DC 20402. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify--

(i) That the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(c) The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(End of clause)

40. APPRENTICES AND TRAINEES (FEB 1988) FAR 52.222-9

(a) *Apprentices.* Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rates) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) *Trainees.* Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) *Equal employment opportunity.* The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(End of clause)

41. COMPLIANCE WITH COPELAND ACT REQUIREMENTS (FEB 1988) FAR 52.222-10

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of clause)

42. SUBCONTRACTS (LABOR STANDARDS) (FEB 1988) FAR 52.222-11

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled *Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination--Debarment, Disputes Concerning Labor Standards, Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility*, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b)(1) Within 14 days after award of the contract, the Contractor shall delivery to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall delivery to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of clause)

43. CONTRACT TERMINATION--DEBARMENT (FEB 1988) FAR 52.222-12

A breach of the contract clauses entitled *Davis-Bacon Act, Contract Work Hours and Safety Standards Act--Overtime Compensation, Apprentices and Trainees, Payrolls and Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility*, may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of clause)

44. COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988) FAR 52.222-13

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are hereby incorporated by reference in this contract.

(End of clause)

45. DISPUTES CONCERNING LABOR STANDARDS (FEB 1988) FAR 52.222-14

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of clause)

46. CERTIFICATION OF ELIGIBILITY (FEB 1988) FAR 52.222-15

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of clause)

47. EQUAL OPPORTUNITY (APR 1984) FAR 52.222-26

(a) If, during any 12-month period (including the 12 months preceding the award of this contract), the Contractor has been or is awarded nonexempt Federal contracts and/or subcontracts that have an aggregate value in excess of \$10,000, the Contractor shall comply with subparagraphs (b)(1) through (11) below. Upon request, the Contractor all provide information necessary to determine the applicability of this clause.

(b) During performing this contract, the Contractor agrees as follows:

(1) The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.

(2) The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. This shall include, but not be limited to, (i) employment, (ii) upgrading, (iii) demotion, (iv) transfer, (v) recruitment or recruitment advertising, (vi) layoff or termination, (vii) rates of pay or other forms of compensation, and (viii) selection for training, including apprenticeship.

(3) The Contractor shall post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer that explain this clause.

(4) The Contractor shall, in all solicitations or advertisement for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(5) The Contractor shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.

(6) The Contractor shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.

(7) The Contractor shall furnish to the contracting agency all information required by Executive Order 11246, as amended, and by the rules, regulations, and orders of the Secretary of labor. Standard Form 100 (EEO-1), or any successor form, is the prescribed form to be filed within 30 days following the award, unless filed within 12 months preceding the date of award.

(8) The Contractor shall permit access to its books, records, and accounts by the contracting agency or the Office of Federal Contract Compliance Programs (OFCCP) for the purposes of investigation to ascertain the Contractor's compliance with the applicable rules, regulations, and orders.

(9) If the OFCCP determines that the Contractor is not in compliance with this clause or any rule, regulation, or order of the Secretary of Labor, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts, under the procedures authorized in Executive Order 11246, as amended. In addition, sanctions may be imposed and remedies invoked against the Contractor as provided in Executive Order 11246, as amended, the rules, regulations, and orders of the Secretary of Labor, or as otherwise provided by law.

(10) The Contractor shall include the terms and conditions of subparagraph (b)(1) through (11) of this clause in every subcontract or purchase order that is not exempted by the rules, regulations, or orders of the Secretary of Labor issued under Executive Order 11246, as amended, so that these terms and conditions will be binding upon each subcontract or vendor.

(11) The Contractor shall take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing these terms and conditions, including sanctions for noncompliance; provided, that if the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of any direction, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

(c) Notwithstanding any other clause in this contract, disputes relative to this clause will be governed by the procedures in 41 CFR 60-1.1.

(End of clause)

48. AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (APR 1984) FAR 52.222-27

(a) *Definitions.*

"Covered area," as used in this clause, means the geographical area described in the solicitation for this contract.

"Director," as used in this clause, means Director, Office of Federal Contract Compliance Programs (OFCCP), United States Department of Labor, or any person to whom the Director delegates authority.

"Employer identification number," as used in this clause, means the Federal Social Security number used on the employer's quarterly federal tax return, U.S. Treasury Department Form 941.

"Minority," as used in this clause, means--

(1) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

(2) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(3) Black (all persons having origins in any of the black African racial groups not of Hispanic origin);

(4) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race);

(b) If the Contractor, or a subcontractor at any tier, subcontracts a portion of the work involving any construction trade, each such subcontract in excess of \$10,000 shall include this clause and the Notice containing the goals for minority and female participation stated in the solicitation for this contract.

(c) If the Contractor is participating in a Hometown Plan (41 CFR 60-4) approved by the U.S. Department of Labor in a covered area, either individually or through an association, its affirmative action obligations on all work in the plan area (including goals) shall comply with the plan for those trades that have unions participating in the plan. Contractors must be able to demonstrate participation in, and compliance with, the provisions of the plan. Each Contractor or subcontractor participating in an approved plan is also required to comply with its obligations under the Equal Opportunity clause, and to make a good faith effort to achieve each goal under the plan in each trade in which it has employees. The overall good-faith performance by other Contractors or subcontractors toward a goal in an approved plan does not excuse any Contractor's or subcontractor's failure to make good-faith efforts to achieve the plan's goals.

(d) The Contractor shall implement the affirmative action procedures in subparagraphs (g)(1) through (16) of this clause. The goals stated in the solicitation for this contract are expressed as percentages of the total hours of employment and training of minority and female utilization that the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where that work is actually performed. The Contractor is expected to make substantially uniform progress toward its goals in each craft.

(e) Neither the terms and conditions of any collective bargaining agreement, nor the failure by a union with which the Contractor has a collective bargaining agreement, to refer minorities or women shall excuse the Contractor's obligations under this clause, Executive Order 11246, as amended, or the regulations thereunder.

(f) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

(g) The Contractor shall take affirmative action to ensure equal employment opportunity. The evaluation of the Contractor's compliance with this clause shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and implement affirmative action steps at least as extensive as the following:

(1) Ensure a working environment free of harassment, intimidation, and coercion at all sites and in all facilities where the Contractor's employees are assigned to work. The Contractor, if possible, will assign two or more women to each construction project. The Contractor shall ensure that foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at these sites or facilities.

(2) Establish and maintain a current list of sources for minority and female recruitment. Provide written notification to minority and female recruitment sources and community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

(3) Establish and maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant, referrals of minorities or females from unions, recruitment sources, or community organizations and the action taken with respect to each individual. If an individual was sent to the union hiring hall for referral and not referred back to the Contractor by the union or, if referred back, not employed by the Contractor, this shall be documented in the file, along with whatever additional actions the Contractor may have taken.

(4) Immediately notify the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred back to the Contractor a minority or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

(5) Develop on-the-job training opportunities and/or participate in training programs for the area that expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the

Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under subparagraph (g)(2) above.

(6) Disseminate the Contractor's equal employment policy by--

(i) Providing notice of the policy to unions and to training, recruitment, and outreach programs, and requesting their cooperation in assisting the Contractor in meeting its contract obligations;

(ii) Including the policy in any policy manual and in collective bargaining agreements;

(iii) Publicizing the policy in the company newspaper, annual report, etc.;

(iv) Reviewing the policy with all management personnel and with all minority and female employees at least once a year; and

(v) Posting the policy on bulletin boards accessible to employees at each location where construction work is performed.

(7) Review, at least annually, the Contractor's equal employment policy and affirmative action obligations with all employees having responsibility for hiring, assignment, layoff, termination, or other employment decisions. Conduct review of this policy with all onsite supervisory personnel before initiating construction work at a job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

(8) Disseminate the Contractor's equal employment policy externally by including it in any advertising in the news media, specifically including minority and female news media. Provide written notification to, and discuss this policy with, other Contractors and subcontractors with which the Contractor does or anticipates doing business.

(9) Direct recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than 1 month before the date for acceptance of applications for apprenticeship or training by any recruitment source, send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

(10) Encourage present minority and female employees to recruit minority persons and women. Where reasonable, provide after-school, summer, and vacation employment to minority and female youth both on the site and in other areas of the Contractor's workforce.

(11) Validate all tests and other selection requirements where required under 41 CFR 60-3.

(12) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities. Encourage these employees to seek or to prepare for through appropriate training, etc., opportunities for promotion.

(13) Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the Contractor's obligations under this contract are being carried out.

(14) Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between sexes.

(15) Maintain a record of solicitations for subcontracts for minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

(16) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's equal employment policy and affirmative action obligations.

(h) The Contractor is encouraged to participate in voluntary associations that may assist in fulfilling one or more of the affirmative action obligations contained in subparagraphs (g)(1) through (16). The efforts of a contractor association, joint contractor-union, contractor-community, or similar group of which the contractor is a member and participate may be asserted as fulfilling one or more of its obligations under subparagraphs (g)(1) through (16), provided the Contractor--

(1) Actively participates in the group;

(2) Makes every effort to ensure that the group has a positive impact on the employment of minorities and women in the industry;

(3) Ensures that concrete benefits of the program are reflected in the Contractor's minority and female workforce participation;

(4) Make a good-faith effort to meet its individual goals and timetables; and

(5) Can provide access to documentation that demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply is the Contractor's, and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

(i) A single goal for minorities and a separate single goal for women shall be established. The Contractor is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and

all women, both minority and nonminority. Consequently, the Contractor may be in violation of Executive Order 11246, as amended, if a particular group is employed in a substantially disparate manner.

(j) The Contractor shall not use goals or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

(k) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts under Executive Order 11246, as amended.

(l) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the Equal Opportunity clause, including suspension, termination, and cancellation of existing subcontracts, as may be imposed or ordered under Executive Order 11246, as amended, and its implementing regulations, by the OFCCP. Any failure to carry out these sanctions and penalties as ordered shall be a violation of this clause and Executive Order 11246, as amended.

(m) The Contractor in fulfilling its obligations under this clause shall implement affirmative action procedures at least as extensive as those prescribed in paragraph (g) above, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of Executive Order 11246, as amended, the implementing regulations, or this clause, the Director shall take action as prescribed in 41 CFR 60-4.8.

(n) The Contractor shall designate a responsible official to--

(1) Monitor all employment-related activity to ensure that the Contractor's equal employment policy is being carried out;

(2) Submit reports as may be required by the Government; and

(3) Keep records that shall at least include for each employee the name, address, telephone number, construction trade, union affiliation (if any), employee identification number, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, separate records are not required to be maintained.

(o) Nothing contained herein shall be construed as a limitation upon the application of other laws that establish different standards of compliance or upon the requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

(End of clause)

49. AFFIRMATIVE ACTION FOR DISABLED AND VIETNAM ERA VETERANS (APR 1998) FAR 52.222-35

(a) *Definition.* As used in this clause--.

All employment openings includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting 3 days or less. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment.

Appropriate office of the State employment service system, means the local office of the Federal-State national system of public employment offices with assigned responsibility to serve the area where the employment opening is to be filled including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.

Positions that will be filled from within the Contractor's organization means employment openings for which no consideration will be given to persons outside the Contractor's organization (including affiliates, subsidiaries, and parent companies) and includes any openings that the Contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a particular opening once an employee decides to consider applicants outside of its organization.

Veteran of the Vietnam era means a person who--

(1) Served on active duty for a period of more than 180 days, any part of which occurred between August 5, 1964, and May 7, 1975, and was discharged or released therefrom with other than a dishonorable discharge; or

(2) Was discharged or released from active duty for a service-connected disability if any part of such active duty was performed between August 5, 1964, and May 7, 1975.

(b) *General.* (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against the individual because the individual is a disabled veteran or a veteran of the Vietnam era. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans' status in all employment practices such as--

(i) Employment;

(ii) Upgrading;

- (iii) Demotion or transfer;
- (iv) Recruitment;
- (v) Advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and
- (viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Vietnam Era Veterans' Readjustment Assistance Act of 1972 (the Act), as amended.

(c) *Listing openings.* (1) The Contractor agrees to list all employment openings existing at contract award or occurring during contract performance, at an appropriate office of the State employment service system in the locality where the opening occurs. These openings include those occurring at any Contractor facility, including one not connected with performing this contract. An independent corporate affiliate is exempt from this requirement.

(2) State and local government agencies holding Federal contracts of \$10,000 or more shall also list all employment openings with the appropriate office of the State employment service.

(3) The listing of employment openings with the State employment service system is required at least concurrently with using any other recruitment source or effort and involves the obligations of placing a bona fide job order, including accepting referrals of veterans and nonveterans. This listing does not require hiring any particular job applicant or hiring from any particular group of job applicants and is not intended to relieve the Contractor from any requirements of Executive orders or regulations concerning nondiscrimination in employment.

(4) Whenever the Contractor becomes contractually bound to the listing terms of this clause, it shall advise the State employment service system, in each State where it has establishments, of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these terms and has so advised the State system, it need not advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this contract clause.

(d) *Applicability.* This clause does not apply to the listing of employment openings which occur and are filled outside the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(e) *Postings.* (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era, and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Deputy Assistant Secretary for Federal Contract Compliance Programs, Department of Labor (Deputy Assistant Secretary), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of the Act, and is committed to take affirmative action to employ, and advance in employment, qualified disabled veterans and veterans of the Vietnam Era.

(f) *Noncompliance.* If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(g) *Subcontracts.* The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Deputy Assistant Secretary to enforce the terms, including action for noncompliance.

(End of clause)

50. AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS (APR 1984) FAR 52.222-36

(a) *General.* (1) Regarding any position for which the employee or applicant for employment is qualified, the Contractor shall not discriminate against any employee or applicant because of physical or mental handicap. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as--

- (i) Employment;
- (ii) Upgrading;
- (iii) Demotion or transfer;
- (iv) Recruitment;
- (v) Advertising;
- (vi) Layoff or termination;
- (vii) Rates of pay or other forms of compensation; and

(viii) Selection for training, including apprenticeship.

(2) The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor (Secretary) issued under the Rehabilitation Act of 1973 (29 U.S.C. 793) (the Act), as amended.

(b) *Postings.* (1) The Contractor agrees to post employment notices stating (i) the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped individuals and (ii) the rights of applicants and employees.

(2) These notices shall be posted in conspicuous places that are available to employees and applicants for employment. They shall be in a form prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor (Director), and provided by or through the Contracting Officer.

(3) The Contractor shall notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act and is committed to take affirmative action to employ, and advance in employment, qualified physically and mentally handicapped individuals.

(e) *Noncompliance.* If the Contractor does not comply with the requirements of this clause, appropriate actions may be taken under the rules, regulations, and relevant orders of the Secretary issued pursuant to the Act.

(d) *Subcontracts.* The Contractor shall include the terms of this clause in every subcontract or purchase order in excess of \$2,500 unless exempted by rules, regulations, or orders of the Secretary. The Contractor shall act as specified by the Director to enforce the terms, including action for noncompliance.

(End of clause)

51. EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA (APR 1998) FAR 52.222-37

(a) Unless the Contractor is a State or local government agency, the contractor shall report at least annually, as required by the Secretary of Labor, on--

(1) The number of disabled veterans and the number of veterans of the Vietnam era in the workplace of the contractor by job category and hiring location; and

(2) The total number of new employees hired during the period covered by the report, and of that total, the number of disabled veterans, and the number of veterans of the Vietnam era.

(b) The above items shall be reported by completing the form entitled "Federal Contractor Veterans' Employment Report VETS-100."

(c) Reports shall be submitted no later than March 31 of each year beginning March 31, 1988.

(d) The employment activity report required by paragraph (a)(2) of this clause shall reflect total hires during the most recent 12-month period as of the ending data selected for the employment profile report required by paragraph (a)(1) of this clause. Contractors may select an ending date: (1) As of the end of any pay period during the period January through March 1 of the year the report is due, or (2) as of December 31, if the contractor has previous written approval from the Equal Employment Opportunity Commission to do so for purposes of submitting the Employer Information Report EEO-1 (Standard Form 100).

(e) The count of veterans reported according to paragraph (a) of this clause shall be based on voluntary disclosure. Each contractor subject to the reporting requirements at 38 U.S.C. 4212 shall invite all disabled veterans and veterans of the Vietnam era who wish to benefit under the affirmative action program at 38 U.S.C. 4212 to identify themselves to the contractor. The invitation shall state that the information is voluntarily provided; that the information will be kept confidential; that disclosure or refusal to provide the information will not subject the applicant or employee to any adverse treatment; and that the information will be used only in accordance with the regulations promulgated under 38 U.S.C. 4212.

(f) *Subcontracts.* The Contractor shall include the terms of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary.

(End of clause)

52. CLEAN AIR AND WATER (APR 1984) FAR 52.223-2

(a) "Air Act," as used in this clause, means the Clean Air Act (42 U.S.C. 7401 et seq.).

"Clean air standards," as used in this clause, means--

(1) Any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, work practices, or other requirements contained in, issued under, or otherwise adopted under the Air Act or Executive Order 11738;

- (2) An applicable implementation plan as described in section 110(d) of the Air Act (42 U.S.C. 7410(d));
- (3) An approved implementation procedure or plan under section 111(c) or section 111(d) of the Air Act (42 U.S.C. 7411(c) or (d)); or

- (4) An approved implementation procedure under section 112(d) of the Air Act (42 U.S.C. 7412(d)).

“Clean water standards,” as used in this clause, means any enforceable limitation, control, condition, prohibition, standard, or other requirement promulgated under the Water Act or contained in a permit issued to a discharger by the EPA or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. 1342), or by local government to ensure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. 1317).

“Compliance,” as used in this clause, means compliance with--

- (1) Clean air or water standards; or
- (2) A schedule or plan ordered or approved by a court of competent jurisdiction, the EPA, or an air or water pollution control agency under the requirements of the Air Act or Water Act and related regulations.

“Facility,” as used in this clause, means any building, plant, installation, structure, mine, vessel or other floating craft, location, or site of operations, owned, leased, or supervised by a Contractor or subcontractor, used in the performance of a contract or subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the EPA determines that independent facilities are collocated in one geographical area.

“Water Act,” as used in this clause, means Clean Water Act (33 U.S.C. 1251 et seq.).

(b) The Contractor agrees--

- (1) To comply with the requirements of section 114 of the Clean Air Act (42 U.S.C. 7414) and section 308 of the Clean Water Act (33 U.S.C. 1318) relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, and all regulations and guidelines issued to implement those acts before the award of this contract;
 - (2) That no portion of the work required by this prime contract will be performed in a facility listed on the EPA List of Violating Facilities on the date when this contract was awarded unless and until the EPA eliminates the name of the facility from the listing;
 - (3) To use best efforts to comply with clean air standards and clean water standards at the facility in which the contract is being performed; and
 - (4) To insert the substance of this clause into any nonexempt subcontract, including this subparagraph (b)(4).
- (End of clause)

53. POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION (APR 1998) FAR 52.223-5

(a) Executive Order 12856 of August 3, 1993, requires Federal facilities to comply with the provisions of the Emergency Planning and Community Right-to-know Act of 1986 (EPCRA) (42 U.S.C. 11001-11050) and the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13101-13109).

(b) The Contractor shall provide all information needed by the Federal facility to comply with the emergency planning reporting requirements of Section 302 of EPCRA; the emergency notice requirements of Section 304 of EPCRA; the list of Material Data Safety Sheets required by Section 311 of EPCRA; the emergency and hazardous chemical inventory forms of Section 312 of EPCRA; the toxic chemical release inventory of Section 313 of EPCRA, which includes the reduction and recycling information required by Section 6607 of PPA; and the toxic chemical reduction goals requirements of Section 3-302 of Executive Order 12856.

(End of clause)

54. DRUG-FREE WORKPLACE (JAN 1997) FAR 52.223-6

(a) Definitions. As used in this clause--

“Controlled substance” means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11-1308.15.

“Conviction” means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

“Criminal drug statute” means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

“Drug-free workplace” means the site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

“Employee” means an employee of a Contractor directly engaged in the performance of work under a Government contract. “Directly engaged” is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

“Individual” means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration), or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor’s workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor’s policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;.

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b)(1) of this clause that, as a condition of continued employment on this contract, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee’s conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Notify the Contracting Officer in writing within 10 days after receiving notice under subdivision (b)(4)(ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subdivision (b)(4)(ii) of this clause of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

(d) In addition to other remedies available to the Government, the Contractor’s failure to comply with the requirements of paragraph (b) or (c) of this clause may, pursuant to FAR 23.506, render the Contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of clause)

55. OZONE-DEPLETING SUBSTANCES (JUN 1996) FAR 52.223-11

(a) *Definition.* “Ozone-depleting substance”, as used in this clause, means any substance designated as Class I by the Environmental Protection Agency (EPA) (40 CFR Part 82), including but not limited to chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform; or any substance designated as Class II by EPA (40 CFR Part 82), including but not limited to hydrochlorofluorocarbons.

(b) The Contractor shall label products which contain or are manufactured with ozone-depleting substances in the manner and to the extent required by 42 U.S.C. 7671j (b), (c), and (d) and 40 CFR Part 82, Subpart E, as follows:

“WARNING: Contains (or manufactured with, if applicable) _____*, a substance(s) which harm(s) public health and environment by destroying ozone in the upper atmosphere.”

*The Contractor shall insert the name of the substance(s).
(End of clause)

56. TOXIC CHEMICAL RELEASE REPORTING (OCT 1996) FAR 52.223-14

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.

(b) A Contractor owned or operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

(1) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(2) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023 (b)(1)(A);

(3) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

(4) The facility does not fall within the Standard Industrial Classification Code (SIC) designations 20 through 39 as set forth in section 19.102 of the Federal Acquisition Regulation (FAR); or

(5) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any one of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and

(2) The Contractor as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of clause)

57. BUY AMERICAN ACT--CONSTRUCTION MATERIALS (JUN 1997) FAR 52.225-5

NOTE: This clause applies only to contracts less than \$6,500,000.

(a) *Definitions.* As used in this clause--

The Buy American Act (41 U.S.C. 10) provides that the Government give preference to domestic construction material.

“Components” means those articles, materials, and supplies incorporated directly into construction materials.

“Construction material” means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a

complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

“Domestic construction material” means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the excepted construction material or components listed by the Government as follows: (List will appear in Section H if required.)

(3) Other foreign construction material may be added to the list in paragraph (b)(2) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(4) The Contractor agrees that only domestic construction material will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(2) of this clause.

(c) *Request for determination.* (1) Contractors requesting to use foreign construction material under paragraph (b)(3) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(3) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration shall be negotiated.

However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration shall not be less than the differential established in paragraph (b)(3)(i) of this clause.

(3) If the Government does not determine that an exception of the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

| Construction material description | Unit of measure | Quantity | (dollars) * | Price |
|---|--------------------|----------|-------------|-------|
| Item 1: | | | | |
| Foreign construction material | | | | |
| Domestic construction material | | | | |
| Item 2: | | | | |
| Foreign construction material | | | | |
| Domestic construction material | | | | |
| List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information. | | | | |

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

This clause applies to the construction work performed under the contract.
(End of clause)

58. RESTRICTIONS ON CERTAIN FOREIGN PURCHASES (OCT 1996) FAR 52.225-11

- (a) Unless advance written approval of the Contracting Officer is obtained, the Contractor shall not acquire for use in the performance of this contract, any supplies or services originating from sources within, or that were located in or transported from or through, countries whose products are banned from importation into the United States under regulations of the Office of Foreign Assets Control, Department of the Treasury. Those countries include Cuba, Iran, Iraq, Libya, and North Korea.
- (b) The Contractor shall not acquire for use in the performance of this contract any supplies or services from entities controlled by the Government of Iraq.
- (c) The Contractor agrees to insert the provisions of this clause, including this paragraph (c), in all subcontracts hereunder.

(End of clause)

59. BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (JUN 1997) FAR 52.225-15

NOTE: This clause applies only to acquisitions with an acquisition value of \$7,311,000 or more.

- (a) *Definitions.* As used in the clause--
- “Components” means those articles, materials, and supplies incorporate directly into construction materials.
- “Construction material” means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.
- “Designated country construction material” means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.
- “Domestic construction material” means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the U.S., if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of

the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

“North American Free Trade Agreement (NAFTA) country” means Canada or Mexico.

“NAFTA country construction material” means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The Trade Agreements Act and the North American Free Trade Agreement (NAFTA) provide that designated country and NAFTA country construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:
(See Section 00800)

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, NAFTA country construction materials, or designated country construction materials will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials if any, listed in paragraph (b)(3) of this clause.

(c) *Request for determination.* (1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction materials shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration all be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration all not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

| Construction material description | Unit of measure | Quantity | Price (dollars) * |
|-----------------------------------|--------------------|----------|----------------------|
| Item 1: | | | |
| Foreign construction material | | | |
| Domestic construction material | | | |
| Item 2: | | | |
| Foreign construction material | | | |
| Domestic construction material | | | |

List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate is issued).

(End of clause)

60. BUY AMERICAN ACT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS ACT AND NORTH AMERICAN FREE TRADE AGREEMENT (MAY 1997) ALTERNATE I (MAY 1997) FAR 52.225-15 I

NOTE: This clause applies only to acquisitions with an acquisition value from \$6,500,000 to \$7,311,000.

(a) *Definitions.* As used in the clause--

“Components” means those articles, materials, and supplies incorporate directly into construction materials.

“Construction material” means an article, material, or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or components of such systems are delivered to the construction site.

“Designated country construction material” means a construction material that (a) is wholly the growth, product, or manufacture of a designated country (as defined at FAR 25.401), or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

“Domestic construction material” means (1) an unmanufactured construction material mined or produced in the United States, or (2) a construction material manufactured in the U.S., if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined to be unavailable pursuant to subparagraph 25.202(a)(2) of the Federal Acquisition Regulation (FAR) shall be treated as domestic.

“North American Free Trade Agreement (NAFTA) country” means Canada or Mexico.

“NAFTA country construction material” means a construction material that (a) is wholly the growth, product, or manufacture of a NAFTA country, or (b) in the case of a construction material which consists in whole or in part of materials from another country or instrumentality, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

(b) (1) The Buy American Act (41 U.S.C. 10a-10d) requires that only domestic construction material be used in performing this contract, except as provided in paragraphs (b)(2), (b)(3), and (b)(4) of this clause.

(2) The North American Free Trade Agreement (NAFTA) provides that NAFTA construction materials are exempted from application of the Buy American Act.

(3) The requirement in paragraph (b)(1) of this clause does not apply to the excepted construction material or components listed by the Government as follows:
(See Section H)

(4) Other foreign construction material may be added to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost would be unreasonable (the cost of a particular domestic construction material shall be determined to be unreasonable when the cost of such material exceeds the cost of foreign material exceeds the cost of foreign material by more than 6 percent, unless the agency head determines a higher percentage to be appropriate);

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(5) The Contractor agrees that only domestic construction materials, or NAFTA country construction materials, will be used by the Contractor, subcontractors, material men, and suppliers in the performance of this contract, except for foreign construction materials, if any, listed in paragraph (b)(3) of this clause.

(c) *Request for determination.* (1) Contractors requesting to use foreign construction material under paragraph (b)(4) of this clause shall provide adequate information for Government evaluation of the request for a determination regarding the inapplicability of the Buy American Act. Each submission shall include a description of the foreign and domestic construction materials, including unit of measure, quantity, price, time of delivery or availability, location of the construction project, name and address of the proposed contractor, and a detailed justification of the reason for use of foreign materials cited in accordance with paragraph (b)(4) of this clause. A submission based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause. The price of construction materials shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(2) If the Government determines after contract award that an exception to the Buy American Act applies, the contract shall be modified to allow use of the foreign construction material, and adequate consideration all be negotiated. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration all not be less than the differential established in paragraph (b)(4)(i) of this clause.

(3) If the Government does not determine that an exception to the Buy American Act applies, the use of that particular foreign construction material will be a failure to comply with the Act.

(d) For evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the following information and any applicable supporting data based on the survey of suppliers shall be included in the request:

FOREIGN AND DOMESTIC CONSTRUCTION MATERIALS PRICE COMPARISON

| Construction material description | Unit of measure | Quantity | (dollars) * | Price |
|-----------------------------------|--------------------|----------|-------------|-------|
| Item 1: | | | | |
| Foreign construction material | | | | |
| Domestic construction material | | | | |
| Item 2: | | | | |
| Foreign construction material | | | | |
| Domestic construction material | | | | |

List name, address, telephone number, and contract for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.

*Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate is issued).
(End of clause)

61. SECONDARY ARAB BOYCOTT OF ISRAEL (JUN 1992) DFARS 252.225-7031

(a) *Definitions.* As used in this clause--

(1) "Foreign person" means any person other than a United States person as defined in Section 16(2) of the Export Administration Act of 1979 (50 U.S.C. App. Sec 2415).

(2) "United States person" is defined in Section 16(2) of the Export Administration Act of 1979 and means any United States resident or national (other than an individual resident outside the United States and employed by other than a United States person), any domestic concern (including any permanent domestic establishment of any foreign concern), and any foreign subsidiary or affiliate (including any permanent foreign establishment) of any domestic concern which is controlled in fact by such domestic concern, as determined under regulations of the President.

(b) *Certification.* By submitting this offer, the Offeror, if a foreign person, company or entity, certifies that it--

(1) Does not comply with the Secondary Arab Boycott of Israel; and

(2) Is not taking or knowingly agreeing to take any action, with respect to the Secondary Boycott of Israel of Arab countries, which 50 U.S.C. App. Sec. 2407(a) prohibits a United States person from taking.

(End of clause)

62. UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (SEP 1996) FAR 52.226-1

(a) For Department of Defense contracts, this clause applies only if the contract includes a subcontracting plan incorporated under the terms of the clause at FAR 52.219-9, Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan. It does not apply to contracts awarded based on a subcontracting plan submitted and approved under paragraph (g) of the clause at 52.219-9.

(b) *Definitions.* As used in this clause:

“Indian” means any person who is a member of any Indian tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any “Native” as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

“Indian-organization” means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., chapter 17.

“Indian-owned economic enterprise” means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership shall constitute not less than 51 percent of the enterprise.

“Indian tribe” means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

“Interested party” means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(c) The Contractor agrees to use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the self-certification of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the self-certification of a subcontractor, the Contracting Officer shall refer the matter to the U.S. Department of the Interior, Bureau of Indian Affairs (BIA), Attn: Chief, Division of Contracting and Grants Administration, 1849 C Street, NW, MS-334A-SIB, Washington, DC 20245. The BIA will determine the eligibility and notify the Contracting Officer. The 5 percent incentive payment will not be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

- (i) The estimated cost of a cost-type contract;
- (ii) The target cost of a cost-plus-incentive-fee prime contract;
- (iii) The target cost and ceiling price of a fixed price incentive prime contract.
- (iv) The price of a firm-fixed-price prime contract.

(3) The amount of the equitable adjustment to the prime contract shall be 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(d) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, shall authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer shall seek funding in accordance with agency procedures. The Contracting Officer’s decision is final and not subject to the Dispute clause of this contract.

(End of clause)

63. AUTHORIZATION AND CONSENT (JUL 1995) FAR 52.227-1

(a) The Government authorizes and consents to all use and manufacture, in performing any contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this

contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold); however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of clause)

64. PATENT INDEMNITY--CONSTRUCTION CONTRACTS (APR 1984) FAR 52.227-4

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents, and employees against liability, including costs and expenses, for infringement upon any United States patent (except a patent issued upon an application that is now or may hereafter be withheld from issue pursuant to a Secrecy Order under 35 U.S.C. 181) arising out of performing this contract or out of the use or disposal by or for the account of the Government of supplies furnished or work performed under this contract.

(End of clause)

65. RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033

(a) Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower-tier subcontractor pursuant to a construction contract, showing in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(b) This clause, including this paragraph (b), shall be included in all subcontracts hereunder at any tier.

(End of clause)

66. ADDITIONAL BOND SECURITY (OCT 1997) FAR 52.228-2

The Contractor shall promptly furnish additional security required to protect the Government and persons supplying labor or materials under this contract if--

(a) Any surety upon any bond, or issuing financial institution for other security, furnished with this contract becomes unacceptable to the Government;

(b) Any surety fails to furnish reports on its financial condition as required by the Government;

(c) The contract price is increased so that the penal sum of any bond becomes inadequate in the opinion of the Contracting Officer; or

(d) An irrevocable letter of credit (ILC) used as security will expire before the end of the period of required security. If the Contractor does not furnish an acceptable extension or replacement ILC, or other acceptable substitute, at least 30 days before an ILC's scheduled expiration, the Contracting Officer has the right to immediately draw on the ILC.

(End of clause)

**67. INSURANCE--WORK ON A GOVERNMENT INSTALLATION (JAN 1997)
FAR 52.228-5**

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of clause)

68. PLEDGES OF ASSETS (FEB 1992) FAR 52.228-11

(a) Offerors shall obtain from each person acting as an individual surety on a bid guarantee, a performance bond, or a payment bond--

- (1) Pledge of assets; and
- (2) Standard Form 28, Affidavit of Individual Surety.

(b) Pledges of assets from each person acting as an individual surety shall be in the form of--

(1) Evidence of an escrow account containing cash, certificates of deposit, commercial or Government securities, or other assets described in FAR 28.203-2 (except see 28.203-2(b)(2) with respect to Government securities held in book entry form) and/or;

(2) A recorded lien on real estate. The offeror will be required to provide--

(i) Evidence of title in the form of a certificate of title prepared by a title insurance company approved by the United States Department of Justice. This title evidence must show fee simple title vested in the surety along with any concurrent owner; whether any real estate taxes are due and payable; and any recorded encumbrances against the property, including the lien filed in favor of the Government as required by FAR 28.203-3(d);

(ii) Evidence of the amount due under any encumbrance shown in the evidence of title;

(iii) A copy of the current real estate tax assessment of the property or a current appraisal dated no earlier than 6 months prior to the date of the bond, prepared by a professional appraiser who certifies that the appraisal has been conducted in accordance with the generally accepted appraisal standards as reflected in the Uniform Standards of Professional Appraisal Practice, as promulgated by the Appraisal Foundation.

(End of clause)

**69. PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)
FAR 52.228-12**

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

70. FEDERAL, STATE, AND LOCAL TAXES (JAN 1991) FAR 52.229-3

(a) "Contract date," as used in this clause, means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification

"All applicable Federal, State, and local taxes and duties," as used in this clause, means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

"After-imposed Federal tax," as used in this clause, means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date but whose exemption was later revoked or reduced during the contract period, on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

"After-relieved Federal tax," as used in this clause, means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable, on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

(b) The contract price includes all applicable Federal, State, and local taxes and duties.

(c) The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.

(d) The contract price shall be decreased by the amount of any after-relieved Federal tax.

(e) The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor's fault, negligence, or failure to follow instructions of the Contracting Officer.

(f) No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceed \$250.

(g) The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price and shall take appropriate action as the Contracting Officer directs.

(h) The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

(End of clause)

71. SUPPLEMENTAL COST PRINCIPLES (DEC 1991) DFARS 52.231-7000

When the allowability of costs under this contract is determined in accordance with Part 31 of the Federal Acquisition Regulation (FAR), allowability shall also be determined in accordance with Part 231 of the Defense FAR Supplement, in effect on the date of this contract.

(End of clause)

72. PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (MAY 1997) FAR 52.232-5

(a) *Payment of price.* The Government shall pay the Contractor the contract price as provided in this contract.

(b) *Progress payments.* The Government shall make progress payments monthly as the work proceeds, or at more frequent intervals as determined by the Contracting Officer, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer.

(1) The Contractor's request for progress payments shall include the following substantiation:

(i) An itemization of the amounts requested, related to the various elements of work required by the contract covered by the payment requested.

(ii) A listing of the amount included for work performed by each subcontractor under the contract.

(iii) A listing of the amount included for work performed by each subcontract under the contract.

(iv) A listing of the amounts previously paid to each such subcontractor under the contract.

(v) Additional supporting data in a form and detail required by the Contracting Officer.

(2) In the preparation of estimates, the Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site also may be taken into consideration if--

(i) Consideration is specifically authorized by this contract; and

(ii) The Contractor furnishes satisfactory evidence that it has acquired title to such material and that the material will be used to perform this contract.

(c) *Contractor certification.* Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made: (However, if the Contractor elects to delete paragraph (c)(4) from the certification, the certification is still acceptable.)

I hereby certify, to the best of my knowledge and belief, that--

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements and the requirements of chapter 39 of Title 31, United States Code; and

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in accordance with the terms and conditions of the subcontract; and

(4) This certification is not to be construed as final acceptance of a subcontractor's performance.

(Name)

(Title)

(Date)

(d) *Refund of unearned amounts.* If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this contract (hereinafter referred to as the “unearned amount”), the Contractor shall--

(1) Notify the Contracting Officer of such performance deficiency; and
(2) Be obligated to pay the Government an amount (computed by the Contracting Officer in the manner provided in paragraph (j) of this clause) equal to interest on the unearned amount from the date of receipt of the unearned amount until--

(i) The date the Contractor notifies the Contracting Officer that the performance deficiency has been corrected; or

(ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

(e) *Retainage.* If the Contracting Officer finds that satisfactory progress was achieved during any period for which a progress payment is to be made, the Contracting Officer shall authorize payment to be made in full. However, if satisfactory progress has not been made, the Contracting Officer may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved. When the work is substantially complete, the Contracting Officer may retain from previously withheld funds and future progress payments that amount the Contracting Officer considers adequate for protection of the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the contract, for which the price is stated separately in the contract, payment shall be made for the completed work without retention of a percentage.

(f) *Title, liability, and reservation of rights.* All material and work covered by progress payments made shall, at the time of payment, become the sole property of the Government, but this shall not be construed as--

(1) Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or

(2) Waiving the right of the Government to require the fulfillment of all of the terms of the contract.

(g) *Reimbursement for bond premiums.* In making these progress payments, the Government shall, upon request, reimburse the Contractor for the amount of premiums paid for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor has furnished evidence of full payment to the surety. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of progress payments attributable to bond premiums.

(h) *Final payment.* The Government shall pay the amount due the Contractor under this contract after--

(1) Completion and acceptance of all work;

(2) Presentation of a properly executed voucher; and

(3) Presentation of release of all claims against the Government arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned under the Assignment of Claims Act of 1940 (31 U.S.C. 3727 and 41 U.S.C. 15).

(i) *Limitation because of undefinitized work.* Notwithstanding any provision of this contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized contract actions. A “contract action” is any action resulting in a contract, as defined in FAR Subpart 2.1, including contract modifications for additional supplies or services, but not including contract modifications that are within the scope and under the terms of the contract, such as contract modifications issued pursuant to the Changes clause, or funding and other administrative changes.

(j) *Interest computation on unearned accounts.* In accordance with 31 U.S.C. 3903(c)(1), the amount payable under subparagraph (d)(2) of this clause shall be--

(1) Computed at the rate of average bond equivalent rates of 91-day Treasury bills auctioned at the most recent auction of such bills prior to the date the Contractor receives the unearned amount; and

(2) Deducted from the next available payment to the Contractor.

(End of clause)

73. INTEREST (JUNE 1996) FAR 52.232-17

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of clause)

74. ASSIGNMENT OF CLAIMS (JAN 1986) ALTERNATE I (APR 1984) FAR 52.232-23 I

(a) The Contractor, under the Assignment of Claims Act, as amended, 31 U.S.C. 3727, 41 U.S.C. 15 (hereafter referred to as "the Act"), may assign its rights to be paid amounts due or to become due as a result of the performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency. The assignee under such an assignment may thereafter further assign or reassign its right under the original assignment to any type of financing institution described in the preceding sentence. Unless otherwise stated in this contract, payments to an assignee of any amounts due or to become due under this contract shall not, to the extent specified in the Act, be subject to reduction or setoff.

(b) Any assignment or reassignment authorized under the Act and this clause shall cover all unpaid amounts payable under this contract, and shall not be made to more than one party, except that an assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in the financing of this contract.

(c) The Contractor shall not furnish or disclose to any assignee under this contract any classified document (including this contract) or information related to work under this contract until the Contracting Officer authorizes such action in writing.

(End of clause)

75. PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (JUN 1997) FAR 52.232-27

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or an electronic funds transfer. Definitions of pertinent terms are set forth in 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) *Invoice Payments--(1) Types of invoice payments.* For purposes of this clause, there are several types of invoice payments which may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. However, if the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 14th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

- (B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):

- (A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date shall be deemed to be the 30th day after the date the Contractor's invoice, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.
- (B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) *Contractor's invoice.* The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a proper invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

- (i) Name and address of the Contractor
- (ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)
- (iii) Contract number or other authorization for work or services performed (including order number and contract line item number).
- (iv) Description of work or services performed.
- (v) Delivery and payment terms (e.g., prompt payment discount terms).
- (vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).
- (vii) Name (where practicable), title, phone number, and mailing address of person to be notified in event of a defective invoice.
- (viii) For payments described in paragraph (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.
- (ix) Any other information or documentation required by the contract.
- (x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) *Interest penalty.* An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in subdivisions (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment will be made on the following business day without incurring a late payment interest penalty.

- (i) A proper invoice was received by the designated billing office.
- (ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested progress payment amount.
- (iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) *Computing penalty amount.* The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to

as the "Renegotiation Board Interest Rate," and it is published in the *Federal Register* semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount, and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in subdivision (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of the time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in accordance with the EFT clause of this contract

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than \$1.00 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) *Prompt payment discounts.* An interest penalty shall also be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) *Additional interest penalty.* (i) If this contract was awarded on or after October 1, 1989, a penalty amount, calculated in accordance with subdivision (a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of \$1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii) (A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands may be postmarked on or before the 40th day after payment was made, except that--

- (1) If the postmarked is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment office on or before the 40th day after payment was made; or
 - (2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.
- (iii) (A) The additional penalty shall be equal to 100 percent of any original late payment, except--
 - (1) The additional penalty shall not exceed \$5,000;
 - (2) The additional penalty shall never be less than \$25; and
 - (3) No additional penalty is owed if the amount of the underlying interest penalty is less than \$1.
- (B) If the interest penalty ceases to accrue in accordance with the limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrued in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(a) of the clause.
- (C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.
- (D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) *Contract Financing Payments.* (1) *Due dates for recurring financing payments.* If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payment shall be made on the 30th day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) *Due dates for other contract financing.* For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) *Interest penalty not applicable.* Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) *Subcontract clause requirements.* The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) *Prompt payment for subcontractors.* A payment clause which obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) *Interest for subcontractors.* An interest penalty clause which obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due to made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligations to pay an interest penalty.

(3) *Subcontract clause flowdown* A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) *Subcontract clause interpretation.* The clauses required by paragraph (c) of this clause shall not be construed to impair the right of Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) *Retainage permitted.* Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to

by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and payment bond;

(2) *Withholding permitted.* Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) *Withholding requirements.* Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) *Subcontractor withholding procedures.* If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) *Subcontractor notice.* Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) *Contracting Officer notice.* Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) *Subcontractor progress payment reduction.* Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) *Subsequent subcontractor payment.* Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under subdivision (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) *Notice to Contracting Officer.* Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) *Interest to Government.* Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f) *Third-party deficiency reports.* (1) *Withholding from subcontractor.* If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under paragraph (f)(1)(i) of this clause.

(2) *Subsequent payment or interest charge.* As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall (i) Pay the amount withheld under paragraph (f)(1)(ii) of this clause to such first-tier subcontractor; or (ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established

by the Secretary of the Treasury, and published in the *Federal Register*, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) *Written notice of subcontractor withholding.* A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--

- (1) The amount to be withheld;
- (2) The specific causes for the withholding under the terms of the subcontract; and
- (3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) *Subcontractor payment entitlement.* The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) *Prime-subcontractor disputes.* A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) *Preservation of prime-subcontractor rights.* Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) *Non-recourse for prime contractor interest penalty.* The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost reimbursement claim may not include any amount for reimbursement of such interest penalty.

(End of clause)

76. PAYMENT BY ELECTRONIC FUNDS TRANSFER (CCR) (JUN 1998) DFARS 252.232-7009

(a) Method of payment. (1) All payments by the Government under this contract shall be made by electronic funds transfer (EFT), except as provided in paragraph (a)(2) or (b) of this clause. As used in this clause, the term "EFT" refers to the funds transfer and may also include the payment information transfer.

(2) In the event the Government is unable to release one or more payments by EFT, the Contractor agrees to either (i) accept payment by check or some other mutually agreeable method of payment, or (ii) request the Government to extend the payment due date until such time as the Government can make payment by EFT (but see paragraph (e) of this clause).

(b) Alternative contractor certification. If the Contractor certifies in writing, as part of its registration with the Central Contractor Registration (CCR) database that it does not have an account with a financial institution and does not have an authorized payment agent, payment shall be made by check to the remittance address contained in the CCR database. All contractor certifications will expire on January 1, 1999.

(c) Contractor's EFT information. Except as provided in paragraph (b) of this clause, the Government shall make payment to the Contractor using the EFT information contained in the CCR database. In the event that the EFT information changes, the Contractor shall be responsible for providing the updated information to the CCR database.

(d) Mechanisms for EFT payment. The Government may make payment by EFT through either an Automated Clearing House subject to the banking laws of the United States or the Federal Reserve Wire Transfer System.

(e) Suspension of payment. If the Contractor's EFT information in the CCR database is incorrect and the Contractor has not certified under paragraph (b) of this clause, the Government need not make payment to the Contractor under this contract until correct EFT information or certification is entered into the CCR database; and any invoice or contract financing request shall be deemed not to be a proper invoice for the purpose of prompt payment under this contract. The prompt payment terms of the contract regarding notice of an improper invoice and delays in accrual of interest penalties apply.

(f) Contractor EFT arrangements. If the Contractor has identified multiple payment receiving points (i.e., more than one remittance address or EFT information set) in the CCR database, and the Contractor has not notified the Government of the payment receiving point applicable to this contract, the Government shall make payment to the first payment receiving point (EFT information set or remittance address as applicable) listed in the CCR database.

(g) Liability for uncompleted or erroneous transfers. (1) If an uncompleted or erroneous transfer occurs because the Government failed to use the Contractor's EFT information in the correct manner, the Government remains responsible for—

- (i) Making a correct payment;
- (ii) Paying any prompt payment penalty due; and
- (iii) Recovering any erroneously directed funds.

(2) If an uncompleted or erroneous transfer occurs because the Contractor's EFT information was incorrect, or was revised within 30 days of Government release of the EFT payment transaction instruction to the Federal Reserve System, and—

- (i) If the funds are no longer under the control of the payment office, the Government is deemed to have made payment and the contractor is responsible for recovery of any erroneously directed funds; or
- (ii) If the funds remain under the control of the payment office, the Government shall not make payment, and the provisions of paragraph (e) of this clause shall apply.

(h) EFT and prompt payment. A payment shall be deemed to have been made in a timely manner in accordance with the prompt payment terms of this contract if, in the EFT payment transaction instruction released to the Federal Reserve System, the date specified for settlement of the payment is on or before the prompt payment due date, provided the specified payment date is a valid date under the rules of the Federal Reserve System.

(i) EFT and assignment of claims. If the Contractor assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Contractor shall require as a condition of any such assignment, that the assignee register in the CCR database and be paid by EFT in accordance with the terms of this clause. In all respects, the requirements of this clause shall apply to the assignee as if it were the Contractor. EFT information that shows the ultimate recipient of the transfer to be other than the Contractor, in the absence of a proper assignment of claims acceptable to the Government, is incorrect EFT information within the meaning of paragraph (e) of this clause.

(j) Liability for change of EFT information by financial agent. The Government is not liable for errors resulting from changes to EFT information made by the Contractor's financial agent.

(k) Payment information. The payment or disbursing office shall forward to the Contractor available payment information that is suitable for transmission as of the date of release of the EFT instruction to the Federal Reserve System. The Government may request the Contractor to designate a desired format and method(s) for delivery of payment information from a list of formats and methods the payment office is capable of executing. However, the Government does not guarantee that any particular format or method of delivery is available at any particular payment office and retains the latitude to use the format and delivery method most convenient to the Government. If the Contractor has certified in accordance with paragraph (b) of this clause or if the Government otherwise make payment by check in accordance with paragraph (a) of this clause, the Government shall mail the payment information to the remittance address contained in the CCR database.

(End of clause)

77. REDUCTION OR SUSPENSION OF CONTRACT PAYMENTS UPON FINDING OF FRAUD (AUG 1992) DFARS 252.232-7006

(a) 10 U.S.C. 2307(e) permits the head of the agency to reduce or suspend further payments to the Contractor upon a written determination by the agency head that substantial evidence exists that the Contractor's request for advance, partial, or progress payments is based on fraud. The provisions of 10 U.S.C. 2307(e) are in addition to any other rights or remedies provided the Government by law or under contract.

(b) Actions taken by the Government in accordance with 10 U.S.C. 2307(e) shall not constitute an excusable delay under the Default clause of this contract or otherwise relieve the Contractor of its obligations to perform under this contract.

(End of clause)

78. DISPUTES (OCT 1995) FAR 52.233-1

(a) This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).

(b) Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.

(c) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. A claim arising under a contract, unlike a claim relating to that contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified as required by subparagraph (d)(2) of this clause. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be

converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(d)(1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.

(2)(i) Contractors shall provide the certification specified in subparagraph (d)(2)(iii) of this clause when submitting any claim--

(A) Exceeding \$100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

(ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

(iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."

(3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.

(e) For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.

(f) The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.

(g) If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use ADR. If the Contractor refuses an offer for alternative disputes resolution, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the request. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in subparagraph (d)(2)(iii) of this clause, and executed in accordance with subparagraph (d)(3) of this clause.

(h) The government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certification, as defined in FAR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claim shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

(i) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

(End of clause)

79. PROTEST AFTER AWARD (AUG 1996) FAR 52.233-3

(a) Upon receipt of a notice of protest (as defined in FAR 33.101) or a determination that a protest is likely (see FAR 33.102(d)), the Contracting Officer may, by written order to the Contractor, direct the Contractor to stop performance of the work called for by this contract. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Upon receipt of the final decision in the protest, the Contracting Officer shall either--

(1) Cancel the stop-work order; or

(2) Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.

(b) If a stop-work order issued under this clause is canceled either before or after a final decision in the protest, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if--

(1) The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and

(2) The Contractor asserts its right to an adjustment within 30 days after the end of the period of work stoppage; *provided*, that if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon a proposal submitted at any time before final payment under this contract.

(c) If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.

(d) If a stop-work order is not canceled and the work covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

(e) The Government's rights to terminate this contract at any time are not affected by action taken under this clause.

(f) If, as the result of the Contractor's intentional or negligent misstatement, misrepresentation, or miscertification, a protest related to this contract is sustained, and the Government pays costs, as provided in FAR 33.102(b)(2) or 33.104(h)(1), the Government may require the Contractor to reimburse the Government the amount of such costs. In addition to any other remedy available, and pursuant to the requirements of Subpart 32.6, the Government may collect this debt by offsetting the amount against any payment due the Contractor under any contract between the Contractor and the Government.

(End of clause)

80. DIFFERING SITE CONDITIONS (APR 1984) FAR 52.236-2

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; *provided*, that the time prescribed in paragraph (a) of this clause for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

(End of clause)

81. SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (APR 1984) FAR 52.236-3

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as to this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

(b) The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any

understanding reached or representation made concerning conditions that can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.
(End of clause)

82. MATERIAL AND WORKMANSHIP (APR 1984) FAR 52.236-5

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide all information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

(End of clause)

83. SUPERINTENDENCE BY THE CONTRACTOR (APR 1984) FAR 52.236-6

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(End of clause)

84. PERMITS AND RESPONSIBILITIES (NOV 1991) FAR 52.236-7

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(End of clause)

85. OTHER CONTRACTS (APR 1984) FAR 52.236-8

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

(End of clause)

86. PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984) FAR 52.236-9

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(End of clause)

87. OPERATIONS AND STORAGE AREAS (APR 1984) FAR 52.236-10

(a) The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

(b) Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(c) The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(End of clause)

88. USE AND POSSESSION PRIOR TO COMPLETION (APR 1984) FAR 52.236-11

(a) The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

(End of clause)

89. CLEANING UP (APR 1984) FAR 52.236-12

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

(End of clause)

90. ACCIDENT PREVENTION (NOV 1991)--ALTERNATE I (NOV 1991) FAR 52.236-13 I

(a) The Contractor shall provide and maintain work environments and procedures which will (1) safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities; (2) avoid interruptions of Government operations and delays in project completion dates; and (3) control costs in the performance of this contract.

(b) For these purposes on contracts for construction or dismantling, demolition, or removal of improvements, the Contractor shall--

(1) Provide appropriate safety barricades, signs, and signal lights;

(2) Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and

(3) Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.

(c) If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.

(d) Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.

(e) The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

(f) Before commencing the work, the Contractor shall--

(1) Submit a written proposed plan for implementing this clause. The plan shall include an analysis of the significant hazards to life, limb, and property inherent in contract work performance and a plan for controlling these hazards; and

(2) Meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program.

(End of clause)

91. SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984) FAR 52.236-15

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payment until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately delivery three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting

Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

(End of clause)

**92. SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FEB 1997)
FAR 52.236-21**

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by," or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place", that is furnished and installed".

(d) Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor.

(End of clause)

93. PRECONSTRUCTION CONFERENCE (FEB 1995) FAR 52.236-26

If the Contracting Officer decides to conduct a preconstruction conference, the successful offeror will be notified and will be required to attend. The Contracting Officer's notification will include specific details regarding the date, time, and location of the conference, any need for attendance by subcontractors, and information regarding the items to be discussed.

(End of clause)

**94. MODIFICATION PROPOSALS--PRICE BREAKDOWN (DEC 1991)
DFARS 252.236-7000**

(a) The Contractor shall furnish a price breakdown, itemized as required and within the time specified by the Contracting Officer, with any proposal for a contract modification.

(b) The price breakdown--

(1) Must include sufficient detail to permit analysis of profit, and of all costs for--

(i) Material;

(ii) Labor;

(iii) Equipment;

(iv) Subcontracts; and

(v) Overhead; and

(2) Must cover all work involved in the modification, whether the work was deleted, added, or changed.

(c) The Contractor shall provide similar price breakdowns to support any amounts claimed for subcontracts.

(d) The Contractor's proposal shall include a justification for any time extension proposed.

(End of clause)

95. BANKRUPTCY (JUL 1995) FAR 52.242-13

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of clause)

96. SUSPENSION OF WORK (APR 1984) FAR 52.242-14

(a) The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order), and (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

(End of clause)

97. POSTAWARD CONFERENCE (DEC 1991) DFARS 252.242-7000

The Contractor agrees to attend any postaward conference convened by the contracting activity or contract administration office in accordance with Federal Acquisition Regulation Subpart 42.5.

(End of clause)

98. CHANGES (AUG 1987) FAR 52.243-4

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes--

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner or performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; *provided*, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances, and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(End of clause)

99. PRICING OF CONTRACT MODIFICATIONS (DEC 1991) DFARS 252.243-7001

When costs are a factor in any price adjustment under this contract, the contract cost principles and procedures in FAR Part 31 and DFARS Part 231, in effect on the date of this contract, apply.

(End of clause)

100. CERTIFICATION OF REQUESTS FOR EQUITABLE ADJUSTMENT (JUL 1997) DFARS 252.243-7002

(a) In accordance with 10 U.S.C. 2410(a), any request for equitable adjustment to contract terms that exceeds the simplified acquisition threshold shall bear, at the time of submission, the following certificate executed by an individual authorized to certify the request on behalf of the Contractor:

I certify that the request is made in good faith, and that the supporting data are accurate and complete to the best of my knowledge and belief.

(Official's Name)

(Title)

- (b) The certification in paragraph (a) of this clause requires full disclosure of all relevant facts, including--
- (1) Cost or pricing data if required in accordance with FAR 15.804-2; and
 - (2) Actual cost data and data to support any estimated costs, even if cost or pricing data are not required.
- (c) The certification requirement in paragraph (a) of this clause does not apply to --
- (1) Requests for routine contract payments; for example, requests for payment for accepted supplies and services, routine vouchers under a cost-reimbursement type contract, or progress payment invoices; or
 - (2) Final adjustments under an incentive provision of the contract.

(d) The amount requested shall accurately reflect the contract adjustment for which the Contractor believes the Government is liable. The request shall include only costs for performing the change, and shall not include any costs that already have been reimbursed or that have been separately claimed. All indirect costs included in the request shall be properly allocable to the change in accordance with applicable acquisition regulations.

(End of clause)

101.SUBCONTRACTS (FIXED-PRICE CONTRACTS) (OCT 1997) FAR 52.244-1

(a) This clause does not apply to firm-fixed-price contracts and fixed-price contracts with economic price adjustment. However, it does apply to subcontracts resulting from unpriced modifications to such contracts.

(b) "Subcontract," as used in this clause, includes but is not limited to purchase orders, and changes and modifications to purchase orders. The Contractor shall notify the Contracting Officer reasonably in advance of entering into any subcontract if the Contractor does not have an approved purchasing system and if the subcontract--

(1) Is proposed to exceed \$100,000; or

(2) Is one of a number of subcontracts with a single subcontractor, under this contract, for the same or related supplies or services, that in the aggregate are expected to exceed \$100,000.

(c) The advance notification required by paragraph (b) above shall include--

(1) A description of the supplies or services to be subcontracted;

(2) Identification of the type of subcontract to be used;

(3) Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected, including the competition obtained;

(4) The proposed subcontract price and the Contractor's cost or price analysis;

(5) The subcontractor's current, complete, and accurate cost or pricing data and Certificate of Current Cost or Pricing Data, if required by other contract provisions;

(6) The subcontractor's Disclosure Statement or Certificate relating to Cost Accounting Standards when such data are required by other provisions of this contract; and

(7) A negotiation memorandum reflecting--

(i) The principal elements of the subcontract price negotiations;

(ii) The most significant considerations controlling establishment of initial or revised prices;

(iii) The reason cost or pricing data were or were not required;

(iv) The extent, if any, to which the Contractor did not rely on the subcontractor's cost or pricing data in determining the price objective and in negotiating the final price;

(v) The extent, if any, to which it was recognized in the negotiation that the subcontractor's cost or pricing data were not accurate, complete, or current; the action taken by the Contractor and subcontractor; and the effect of any such defective data on the total price negotiated;

(vi) The reasons for any significant difference between the Contractor's price objective and the price negotiated; and

(vii) A complete explanation of the incentive fee or profit plan when incentives are used. The explanation shall identify each critical performance element, management decisions used to quantify each incentive element, reasons for the incentives, and a summary of all trade-off possibilities considered.

(d) The Contractor shall obtain the Contracting Officer's written consent before placing any subcontract for which advance notification is required under paragraph (b) above. However, the Contracting Officer may ratify in writing any such subcontract. Ratification shall constitute the consent of the Contracting Officer.

(e) Even if the Contractor's purchasing system has been approved, the Contractor shall obtain the Contracting Officer's written consent before placing subcontracts identified below:

(f) Unless the consent or approval specifically provides otherwise, neither consent by the Contracting Officer to any subcontract nor approval of the Contractor's purchasing system shall constitute a determination (1) of the acceptability of any subcontract terms or conditions, (2) of the acceptability of any subcontract price or of any amount paid under any subcontract, or (3) to relieve the Contractor of any responsibility for performing this contract.

(g) No subcontract placed under this contract shall provide for payment on a cost-plus-a-percentage-of-cost basis, and any fee payable under cost-reimbursement subcontracts shall not exceed the fee limitations in subsection 15.404(c)(4)(i) of the Federal Acquisition Regulation (FAR).

(h) The Government reserves the right to review the Contractor's purchasing system as set forth in FAR Subpart 44.3
(End of clause)

102. GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS) (DEC 1989) FAR 52.245-2

NOTE: This clause applies only when the acquisition cost of all Government-furnished property to be involved in the contract is more than \$100,000.

(a) *Government-furnished property.* (1) The Government shall deliver to the Contractor, for use in connection with and under the terms of this contract, the Government-furnished property described in the Schedule or specifications together with any related data and information that the Contractor may request and is reasonably required for the intended use of the property (hereinafter referred to as "Government-furnished property").

(2) The delivery or performance dates for this contract are based upon the expectation that Government-furnished property suitable for use (except for property furnished "as is") will be delivered to the Contractor at the times stated in the Schedule or, if not so stated, in sufficient time to enable the Contractor to meet the contract's delivery or performance dates.

(3) If Government-furnished property is received by the Contractor in a condition not suitable for the intended use, the Contractor shall, upon receipt of it, notify the Contracting Officer, detailing the facts, and, as directed by the Contracting Officer and at Government expense, either repair, modify, return, or otherwise dispose of the property. After completing the directed action and upon written request of the Contractor, the Contracting Officer shall make an equitable adjustment as provided in paragraph (h) of this clause.

(4) If Government-furnished property is not delivered to the Contractor by the required time, the Contracting Officer shall, upon the Contractor's timely written request, make a determination of the delay, if any, caused the Contractor and shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(b) *Changes in Government-furnished property.* (1) The Contracting Officer may, by written notice, (i) decrease the Government-furnished property provided or to be provided under this contract, or (ii) substitute other Government-furnished property for the property to be provided by the Government, or to be acquired by the Contractor for the Government, under this contract. The Contractor shall promptly take such action as the Contracting Officer may direct regarding the removal, shipment, or disposal of the property covered by such notice.

(2) Upon the Contractor's written request, the Contracting Officer shall make an equitable adjustment to the contract in accordance with paragraph (h) of this clause, if the Government has agreed in the Schedule to make the property available for performing this contract and there is any--

(i) Decrease or substitution in this property pursuant to subparagraph (b)(1) above; or

(ii) Withdrawal of authority to use this property, if provided under any other contract or lease.

(c) *Title in Government property.* (1) The Government shall retain title to all Government-furnished property.

(2) All Government-furnished property and all property acquired by the Contractor, title to which vests in the Government under this paragraph (collectively referred to as "Government property"), are subject to the provisions of this clause. However, special tooling accountable to this contract is subject to the provisions of the Special Tooling clause and is not subject to the provisions of this clause. Title to Government property shall not be affected by its incorporation into or attachment to any property not owned by the Government, nor shall Government property become a fixture or lose its identity as personal property by being attached to any real property.

(3) Title to each item of facilities and special test equipment acquired by the Contractor for the Government under this contract shall pass to and vest in the Government when its use in performing this contract commences or when the Government has paid for it, whichever is earlier, whether or not title previously vested in the Government.

(4) If this contract contains a provision directing the Contractor to purchase material for which the Government will reimburse the Contractor as a direct item of cost under this contract--

(i) Title to material purchased from a vendor shall pass to and vest in the Government upon the vendor's delivery of such material; and

(ii) Title to all other material shall pass to and vest in the Government upon--

(A) Issuance of the material for use in contract performance;

(B) Commencement of processing of the material or its use in contract performance; or

(C) Reimbursement of the cost of the material by the Government, whichever occurs first.

(d) *Use of Government property.* The Government property shall be used only for performing this contract, unless otherwise provided in the contract or approved by the Contracting Officer.

(e) *Property administration.* (1) The Contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with Federal Acquisition Regulation (FAR) Subpart 45.5, as in effect on the date of this contract.

(2) The Contractor shall establish and maintain a program for the use, maintenance, repair, protection, and preservation of Government property in accordance with sound industrial practice and the applicable provisions of Subpart 45.5 of the FAR.

(3) If damage occurs to Government property, the risk of which has been assumed by the Government under this contract, the Government shall replace the items or the Contractor shall make such repairs as the Government directs. However, if the Contractor cannot effect such repairs with the time required, the Contractor shall dispose of the property as directed by the Contracting Officer. When any property for which the Government is responsible is replaced or repaired, the Contracting Officer shall make an equitable adjustment in accordance with paragraph (h) of this clause.

(4) The Contractor represents that the contract price does not include any amount for repairs or replacement for which the Government is responsible. Repairs or replacement of property for which the Contractor is responsible shall be accomplished by the Contractor at its own expense.

(f) *Access.* The Government and all its designees shall have access at all reasonable times to the premises in which any Government property is located for the purpose of inspecting the Government property.

(g) *Risk of loss.* Unless otherwise provided in this contract, the Contractor assumes the risk of, and shall be responsible for, any loss or destruction of, or damage to, Government property upon its delivery to the Contractor or upon passage of title to the Government under paragraph (c) of this clause. However, the Contractor is not responsible for reasonable wear and tear to Government property or for Government property properly consumed in performing this contract.

(h) *Equitable adjustment.* When this clause specifies an equitable adjustment, it shall be made to any affected contract provision in accordance with the procedures of the Changes clause. When appropriate, the Contracting Officer may initiate an equitable adjustment in favor of the Government. The right to an equitable adjustment shall be the Contractor's exclusive remedy. The Government shall not be liable to suite for breach of contract for--

- (1) Any delay in delivery of Government-furnished property;
- (2) Delivery of Government-furnished property in a condition not suitable for its intended use;
- (3) A decrease in or substitution of Government-furnished property; or
- (4) Failure to repair or replace Government property for which the Government is responsible.

(i) *Final accounting and disposition of Government property* Upon completing this contract, or at such earlier dates as may be fixed by the Contracting Officer, the Contractor shall submit, in a form acceptable to the Contracting Officer, inventory schedules covering all items of Government property (including any resulting scrap) not consumed in performing this contract or delivered to the Government. The Contractor shall prepare for shipment, delivery f.o.b. origin, or dispose of the Government property as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as the Contracting Officer directs.

(j) *Abandonment and restoration of Contractor's premises.* Unless otherwise provided herein, the Government--

(1) May abandon any Government property in place, at which time all obligations of the Government regarding such abandoned property shall cease; and

(2) Has no obligation to restore or rehabilitate the Contractor's premises under any circumstances (e.g., abandonment, disposition upon completion of need, or upon contract completion). However, if the Government-furnished property (listed in the Schedule or specifications) is withdrawn or is unsuitable for the intended use, or if other Government property is substituted, then the equitable adjustment under paragraph (h) of this clause may properly include restoration or rehabilitation costs.

(k) *Communications.* All communications under this clause shall be in writing.

(l) *Overseas contracts.* If this contract is to be performed outside of the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

103. GOVERNMENT-FURNISHED PROPERTY (SHORT FORM) (APR 1984) FAR 52.245-4

NOTE: This clause applies only when the acquisition cost of all Government-furnished property to be involved in the contract is \$100,000 or less.

(a) The Government shall delivery to the Contractor, at the time and locations stated in this contract, the Government-furnished property described in the Schedule or specifications. If that property, suitable for its intended used, is not delivered to the Contractor, the Contracting Officer shall equitably adjust affected provisions of this contract in accordance with the Changes clause when--

- (1) The Contractor submits a timely written request for an equitable adjustment; and
- (2) The facts warrant an equitable adjustment.

(b) Title to Government-furnished property shall remain in the Government. The Contractor shall use the Government-furnished property only in connection with this contract. The Contractor shall maintain adequate property control records in accordance with sound industrial practice and will make such records available for Government inspection at all reasonable times, unless the clause at Federal Acquisition Regulation 52.245-1, Property Records, is included in this contract.

(c) Upon delivery of Government-furnished property to the Contractor, the Contractor assumes, the risk and responsibility for its loss or damage, except--

- (1) For reasonable wear and tear;
- (2) To the extent property is consumed in performing this contract; or
- (3) As otherwise provided for by the provisions of this contract.

(d) Upon completing this contract, the Contractor shall follow the instructions of the Contracting Officer regarding the disposition of all Government-furnished property not consumed in performing this contract or previously delivered to the Government. The Contractor shall prepare for shipment, delivery f.o.b. origin, or dispose of the Government property, as may be directed or authorized by the Contracting Officer. The net proceeds of any such disposal shall be credited to the contract price or shall be paid to the Government as directed by the Contracting Officer.

(e) If this contract is to be performed outside the United States of America, its territories, or possessions, the words "Government" and "Government-furnished" (wherever they appear in this clause) shall be construed as "United States Government" and "United States Government-furnished," respectively.

(End of clause)

104. REPORTS OF GOVERNMENT PROPERTY (MAY 1994) DFARS 252.245-7001

(a) The Contractor shall provide an annual report--

- (1) For all DoD property for which the Contractor is accountable under the contract;
- (2) Prepared in accordance with the requirements of DD Form 1662, DoD Property in the Custody of Contractors, or approved substitute, including instructions on the reverse side of the form;
- (3) In duplicate, to the cognizant Government property administrator, no later than October 31.

(b) The Contractor is responsible for reporting all Government property accountable to this contract, including that at subcontractor and alternate locations.

(End of clause)

105. INSPECTION OF CONSTRUCTION (AUG 1996) FAR 52.246-12

(a) *Definition.* "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not--

- (1) Relieve the Contractor of responsibility for providing adequate quality control measures;
- (2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;
- (3) Constitute or imply acceptance; or
- (4) Affect the continuing rights of the Government after acceptance of the complete work under paragraph (i)

below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

106. VALUE ENGINEERING--CONSTRUCTION (MAR 1989)--ALTERNATE I (APR 1984) FAR 52.248-3 I

(a) *General.* The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

(b) *Definitions.* "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs, including subcontractors' development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP): means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
- (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; *provided*, that it does not involve a change--
 - (i) In deliverable end item quantities only; or
 - (ii) To the contract type only.

(c) *VECP preparation.* As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

(5) A predicting of any effects the proposed change would have on collateral costs to the agency.

(6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) *Submission.* The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) *Government action.* (1) The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decisions. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

(f) *Sharing.* (1) *Rates.* The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 percent for cost-reimbursement contracts.

(2) *Payment.* Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

(i) Accept the VECP;

(ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) Provide the Contractor's share of savings by adding the amount calculated to the contract price or fee.

(g) *Subcontracts.* The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; *provided*, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(h) *Data.* The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering--Construction clause of contract _____, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of clause)

**107. TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE)
(SEP 1996)--ALTERNATE I (SEP 1996) FAR 52.249-2 I**

(a) The Government may terminate performance of the work under this contract in whole or in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.

(b) After receipt of a Notice of Termination and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:

- (1) Stop work as specified in the notice.
 - (2) Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.
 - (3) Terminate all subcontracts to the extent they relate to the work terminated.
 - (4) Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.
 - (5) With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.
 - (6) As directed by the Contracting Officer, transfer title and delivery to the Government (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated, and (ii) the completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.
 - (7) Complete performance of the work not terminated.
 - (8) Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.
 - (9) Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in subparagraph (b)(6) of this clause; *provided*, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.
- (c) The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.
- (d) After expiration of the plant clearance period as defined in Subpart 45.6 of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.
- (e) After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of

information available, the amount, if any due the Contractor because of the termination and shall pay the amount determined.

(f) Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in subparagraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.

(g) If the Contractor and the Contracting Officer fail to agree on the whole amount to be paid because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:

(1) For contract work performed before the effective date of termination, the total (without duplication of any items) of--

(i) The cost of this work;

(ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and

(iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (iii) and shall reduce the settlement to reflect the indicated rate of loss.

(2) The reasonable costs of settlement of the work terminated, including--

(i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;

(ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and

(iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.

(h) Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.

(i) The cost principles and procedures of Part 31 of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.

(j) The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is not right of appeal.

(k) In arriving at the amount due the Contractor under this clause, there shall be deducted--

(1) All unliquidated advance or other payments to the Contractor under the terminated portion of this contract;

(2) Any claim which the Government has against the Contractor under this contract; and

(3) The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.

(l) If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.

(m)(1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.

(2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.

(n) Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.

(End of clause)

108. DEFAULT (FIXED-PRICE CONSTRUCTION) (APR 1984) FAR 52.249-10

(a) If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.

(b) The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if--

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God or of the public enemy, (ii) acts of the Government in either its sovereign or contractual capacity, (iii) acts of another Contractor in the performance of a contract with the Government, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

(d) The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

(End of clause)

109. COMPUTER GENERATED FORMS (JAN 1991) FAR 52.253-1

(a) Any data required to be submitted on a Standard or Optional Form prescribed by the Federal Acquisition Regulation (FAR) may be submitted on a computer generated version of the form, *provided* the form carries the Standard or Optional Form number and edition data.

(b) Unless prohibited by agency regulations, any data required to be submitted on an agency unique form prescribed by an agency supplement to the FAR may be submitted on a computer generated version of the form provided there is no change to the name, content, or sequence of the data elements on the form and provided the form carries the agency form number and edition data.

(c) If the Contractor submits a computer generated version of a form that is different than the required form, then the rights and obligations of the parties will be determined based on the content of the required form.

(End of clause)

END OF SECTION 00700

Section 00800 Index

| | |
|---|----|
| 01. COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK..... | 3 |
| 02. LIQUIDATED DAMAGES--CONSTRUCTION | 3 |
| 03. thru 5. NOT USED..... | 3 |
| 06. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS | 3 |
| 07. NOT USED | 6 |
| 08. RIGHTS IN SHOP DRAWINGS | 6 |
| 09. AS-BUILT DRAWINGS | 6 |
| | |
| 10. EQUIPMENT DATA | 8 |
| 11. PHYSICAL DATA..... | 8 |
| 12. UTILITIES..... | 9 |
| 13. NOT USED | 10 |
| 14. LAYOUT OF WORK..... | 10 |
| 15. PERFORMANCE OF WORK BY THE CONTRACTOR | 10 |
| 16. NOT USED | 11 |
| 17. SUPERINTENDENCE OF SUBCONTRACTORS | 11 |
| 18. IDENTIFICATION OF EMPLOYEES | 11 |
| 19. CONTRACTOR-PREPARED PROGRESS CHART..... | 11 |
| | |
| 20. WARRANTY OF CONSTRUCTION..... | 12 |
| 21. thru 27. NOT USED..... | 18 |
| 28. IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY | 18 |
| 29. AGGREGATE SOURCES | 18 |
| | |
| 30. NOT USED | 19 |
| 31. PROJECT SIGN..... | 19 |
| 32. NOT USED | 20 |
| 33. WAGE RATES | 20 |
| 34. NOT USED | 20 |
| 35. INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY | 20 |
| 36. NOT USED | 20 |
| 37. GOVERNMENT FIELD OFFICE FACILITIES AND SERVICES..... | 20 |
| 38. COMPLIANCE WITH POST/BASE REGULATIONS..... | 21 |
| 39. EQUIPMENT AND OWNERSHIP AND OPERATING EXPENSE SCHEDULE..... | 21 |
| | |
| 40. LABOR, EQUIPMENT, AND MATERIAL REPORTS..... | 22 |
| 41. NOT USED | 23 |
| 42. PROGRESS PHOTOGRAPHS | 24 |
| 43. PAYMENT FOR MATERIALS DELIVERED OFFSITE..... | 24 |
| 44. NOT USED | 24 |
| 45. INSURANCE--WORK ON A GOVERNMENT INSTALLATION..... | 24 |
| 46. IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM | 25 |
| 47. NOT USED | 25 |
| 48. DEFINITIONS..... | 25 |
| 49. NOT USED | 26 |
| | |
| 50. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER..... | 26 |
| 51. NOT USED | 26 |
| 52. USE OF INCLINOMETER FOR LONG BED DUMP TRUCKS | 26 |
| 53. AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL..... | 26 |

| | |
|--|----|
| 54. FIRE PROTECTION DURING CONSTRUCTION | 27 |
| 55. HAUL ROADS..... | 27 |
| 56. RADIOACTIVE MATERIAL/EQUIPMENT | 27 |
| 57. NOT USED | 28 |
| 58. CONSTRUCTION HAZARD COMMUNICATION..... | 28 |
| 59. CORPS OF ENGINEERS PLAQUE..... | 29 |
| 60. NOT USED | 29 |
| 61. MECHANICAL ROOM LAYOUT..... | 29 |
| 62. RIGHTS IN TECHNICAL DATA--NONCOMMERCIAL ITEMS | 29 |
| 63. LIMITATIONS ON THE USE OR DISCLOSURE OF GOVERNMENT-FURNISHED INFORMATION MARKED WITH RESTRICTIVE LEGEND | 39 |
| 64. thru 67. NOT USED..... | 40 |
| 68. FIRMR APPLICABILITY..... | 40 |
| 69. BASIS FOR SETTLEMENT OF PROPOSALS..... | 40 |
| 70. NOT USED | 40 |
| 71. PARTNERING..... | 41 |
| 72. thru 82. NOT USED..... | 41 |
| 83. YEAR 2000 COMPLIANCE | 41 |

SECTION 00800

SPECIAL CONTRACT REQUIREMENTS

2 January 1996

1. COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK (APR 1984)
FAR 52.211-10. The Contractor shall be required to commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, prosecute said work diligently, and complete the entire work ready for use not later than 540 calendar days after date of receipt of notice to proceed. The time stated for completion shall include as-built drawings, O&M manuals, operational tests/reports/training/instructions, equipment lists, and final cleanup of the premises.

2 January 1996

2. LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984) FAR 52.211-12.

2.1 If the Contractor fails to complete the work within the time specified in the contract, or any extension, the Contractor shall pay to the Government as liquidated damages, the sum of \$1,500.00 for each day of delay.

2.2 If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

2.3 If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

3. thru 5. NOT USED.

1 August 1996

(2) 6. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS (DEC 1991) DFARS 252.236-7001.

6.1 The Government--

(1) Will furnish the Contractor one set of reproducibles, of half-size drawings.

(2) Drawings and specifications are available in the office of the Corps of Engineers, Department of the Army, Room 821, Dr. Martin Luther King, Jr. Place, Louisville, Kentucky.

6.2 The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies; and

(4) Be responsible for any errors which might have been avoided by complying with paragraph 6.2 (1), (2) and (3).

6.3 Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the

drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

6.4 The work shall conform to the specifications and the contract drawings identified on the following index of drawings:

19 October 1987

TABLE OF DRAWINGS

| SHEET NUMBER | REFERENCE NUMBER | TITLE |
|--------------------------|---------------------|---|
| VOLUME 1 | | |
| 1 | X-1 | LOCATION MAP AND VICINITY MAP |
| 2 | X-2 | INDEX OF DRAWINGS |
| 3 | X-3 | STANDARD SYMBOLS |
| 4 | X-4 | STANDARD ABBREVIATIONS |
| CIVIL | | |
| 5 | C-1 | GENERAL SITE PLAN |
| 6 | C-2 | GENERAL SITE PLANS, CLEARING AND REMOVAL |
| 7 | C-3 | DEMOLITION OF BUILDINGS NO. 9261, 9676 AND 9227 |
| 8 | C-4 | DEMOLITION OF BUILDINGS NO. 6111, 9260, 9237 AND 9612 |
| 9 | C-5 | DEMOLITION OF BUILDINGS NO. 9257 AND 9205 |
| 10 | C-6 | DEMOLITION OF BUILDINGS NO. 9609 AND 9610 |
| 11 | C-7 | TYPICAL ROADS, TRAILS AND PARKING SECTIONS |
| 12 | C-8 | AMTC EMPLACEMENT |
| 13 | C-9 | AMTC BERMS AND DETAILS |
| 14 | C-10 | STATIONARY ARMOR TARGET, DOOR/WINDOW & BUNKER TARGET EMPLACEMENT |
| 15 | C-11 | DOUBLE STATIONARY ARMOR AND MODIFIED DIAMOND CLUSTER |
| 16 | C-12 | STATIONARY ARMOR TARGET & COMBINATION TARGET BERM AND DETAILS |
| 17 | C-13 | STATIONARY INFANTRY TARGET |
| 18 | C-14 | INFANTRY TARGET BERMS AND DETAILS |
| 19 | C-15 | L-SHAPED FOXHOLE DETAILS |
| 20 | C-16 | TURN PAD DETAILS (OPTION NO. 7) |
| 21 | C-17 | DRAINAGE DETAILS |
| 22 | C-18 | TARGET DETAILS FOR HE-LANES |
| 23-24 | C-19 thru C-20 | MISCELLANEOUS DETAILS |
| 25-26 | C-21 thru C-22 | FENCE AND DETAILS |
| 27-56 | C-23 thru C-52 | RANGE PLAN |
| 57 | C-53 | CP0QC GRADING PLAN |
| 58 | C-54 | CPQC DETAILS |
| 59-63 | C-55 thru C-59 | ADMINISTRATIVE AREA LAYOUT AND GRADING PLAN |
| 64 | C-60 | TARGET SCHEDULES LANES 1-5 |
| 65 | C-61 | TARGET SCHEDULES LANES 6-10 AND HE LANES 1-3 |
| 66 | C-62 | ROADWAY CURVE SCHEDULE |
| 67 | C-63 | CULVERT SCHEDULE |
| EROSION CONTROL | | |
| 68 | EC-1 | EROSION CONTROL DETAILS |
| FOUNDATION AND MATERIALS | | |
| 69 | F-1 | SOIL CLASSIFICATION |

VOLUME 2

| | | |
|---------|--------------------|-----------------------------|
| 70-94 | PX-1 thru PX-25 | PROFILES AND CROSS SECTIONS |
| 95-175 | PX-26 thru PX-106 | LANE PROFILES |
| 176-187 | PX-107 thru PX-118 | LANE CROSS SECTIONS |
| 188-203 | PX-119 thru PX-134 | ROADWAY PROFILES |
| 204 | PX-135 | ROADWAY CROSS SECTIONS |
| 205 | PX-136 | AMTC PROFILE |
| | | AMTC CROSS SECTIONS |

VOLUME 3

| | | |
|---------|----------------|---|
| 206-211 | L-1 thru L-6 | LANDSCAPE |
| 212 | L-7 | PARTIAL SITE: LANDSCAPE PLAN |
| | | MISCELLANEOUS PLANT DETAILS |
| | | ARCHITECTURAL |
| 213 | A-1 | CONTROL BUILDING PLAN AND ELEVATION |
| 214 | A-2 | CONTROL BUILDING SECTIONS AND DETAILS |
| 215 | A-3 | HE CONTROL TOWER PLAN AND ELEVATION |
| 216 | A-4 | HEADQUARTERS BUILDING (OPTION NO. 1) |
| 217 | A-5 | GENERAL INSTRUCTION BUILDING PLAN, ELEVATION AND DETAILS |
| 218 | A-6 | RANGE SUPPORT BUILDING (OPTION NO. 2) |
| 219 | A-7 | LATRINE AND SHOWER BUILDING PLAN AND ELEVATIONS (OPTION NO. 3) |
| 220 | A-8 | LATRINE AND SHOWER BUILDING SECTIONS AND DETAILS (OPTION NO. 3) |
| 221 | A-9 | LATRINE PLAN, ELEVATIONS AND DETAILS |
| 222 | A-10 | AMMUNITION BREAKDOWN BUILDING PLAN, SCHEDULES, ELEVATIONS AND DETAILS |
| 223 | A-11 | COVERED BLEACHERS |
| 224 | A-12 | COVERED MESS (OPTION NO. 4) |
| 225 | A-13 | TOOLS/PARTS STORAGE ROOM - ADD. BUILDING NO. 6035 |
| 226 | A-14 | TENT FRAMING DETAILS (OPTION NO. 6) |
| 227-228 | A-15 thru A-16 | DETAILS OF BUILDING SEISMIC REINFORCING |
| | | STRUCTURAL |
| 229 | S-1 | CONTROL TOWER STRUCTURAL PLANS |
| 230 | S-2 | CONTROL TOWER STRUCTURAL ELEVATIONS |
| 231 | S-3 | CONTROL TOWER SECTIONS AND DETAILS |
| 232 | S-4 | HE CONTROL TOWER STRUCTURAL PLANS AND SECTIONS |
| 233 | S-5 | HE CONTROL TOWER STRUCTURAL ELEVATIONS AND SECTIONS |
| 234-235 | S-6 thru S-7 | HE CONTROL TOWER STRUCTURAL SECTIONS AND DETAILS |
| 236 | S-8 | HEADQUARTERS BUILDING, FOUNDATION PLAN, SECTIONS AND DETAILS |
| 237 | S-9 | GENERAL INSTRUCTION BUILDING, FOUNDATION PLAN, SECTIONS & DETAILS |
| 238 | S-10 | RANGE SUPPORT BUILDING, FOUNDATION PLAN, SECTIONS & DETAILS |
| 239 | S-11 | LATRINE AND SHOWER BUILDING STRUCTURAL PLAN AND SECTIONS |
| 240 | S-12 | LATRINE BUILDING, STRUCTURAL PLAN AND SECTIONS |
| 241 | S-13 | AMMUNITION BREAKDOWN BUILDING |
| 242 | S-14 | COVERED BLEACHERS |
| 243 | S-15 | COVERED MESS |
| 244 | S-16 | TOOL/PARTS STORAGE, ROOM - ADD BLDG NO. 6035, SECTIONS & DETAILS |
| | | PLUMBING |
| 245 | P-1 | PLUMBING FLOOR PLANS |
| 246 | P-2 | PLUMBING FLOOR PLANS AND RISERS |
| | | MECHANICAL |
| 247 | M-1 | HVAC FLOOR PLANS |
| 248 | M-2 | HVAC FLOOR PLANS |
| 249 | M-3 | HVAC SCHEDULES AND DETAILS |
| 250 | M-4 | HVAC CONTROL DIAGRAMS |

| | | |
|---------|----------------|--|
| | | ELECTRICAL |
| 251-256 | E-1 thru E-7 | ELECTRICAL SITE PLAN - RANGE POWER DISTRIBUTION |
| 257-262 | E-8 thru E-12 | ELECTRICAL SITE PLAN - DATA SYSTEM DISTRIBUTION |
| 263-264 | E-13 thru E-14 | POWER DISTRIBUTION SINGLE LINE DIAGRAM |
| 265 | E-15 | PANEL SCHEDULES |
| 266-267 | E-16 thru E-17 | DATA SYSTEM SINGLE LINE DIAGRAM |
| 268 | E-18 | AMTC EMPLACEMENT AND DETAILS |
| 269 | E-19 | ELECTRICAL LEGEND AND FIXTURE SCHEDULE |
| 270 | E-20 | CONTROL BUILDING AND HE CONTROL TOWER ELECTRICAL PLANS |
| 271-273 | E-21 thru E-23 | ELECTRICAL FLOOR PLANS |
| 274 | E-24 | ELECTRICAL DETAILS |
| 275 | E-25 | ELECTRICAL RISER DIAGRAMS |
| 276 | E-26 | BUILDING PANEL SCHEDULES |
| 277 | E-27 | DATA BREAKOUT BOX DETAIL |
| 278 | E-28 | TOWER JUNCTION BOX DETAIL & AMTC BUS BAR COVER |
| 279 | E-29 | CABLE JUNCTION BOX DETAIL |
| 280 | E-30 | ELECTRICAL DETAILS |
| 281 | E-31 | POWER DISTRIBUTION SINGLE LINE DIAGRAM |

7. NOT USED.

17 JULY 1992

8. RIGHTS IN SHOP DRAWINGS (APR 1966) DFARS 252.227-7033.

8.1 Shop drawings for construction means drawings, submitted to the Government by the Construction Contractor, subcontractor or any lower tier subcontractor pursuant to a construction contract, showing detail (I) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., form, fit, and attachment details) of materials or equipment. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

8.2 This clause, including this paragraph (8.2), shall be included in all subcontracts hereunder at any tier.

2 Feb 1998

9. AS-BUILT DRAWINGS.

9.1 Payment for As-Built Drawings. During the progress of the job, the Contractor shall keep a careful record at the jobsite of all as-built conditions which differ from the contract drawings. The Contractor shall enter such as-built conditions on as-built drawings promptly but in no case later than on a weekly basis. If the Contractor fails to maintain the as-built drawings as required herein, the Contracting Officer will deduct from the monthly progress payment, an amount representing the estimated monthly cost of maintaining the as-built drawings. Final payment with respect to separately priced facilities or the contract as a whole, will be withheld until proper as-built drawings have been furnished to and accepted by the Contracting Officer.

9.2 Maintenance of As-Built Drawings. All as-built conditions which differ from the contract drawings, will be maintained in red on a master set of contract drawings suitable for reproducing. The Contractor shall provide to the Government this master set of as-built drawings six (6) weeks prior to occupancy of the facilities by the Government. This document will be used by the Government for update of project CADD files in order to facilitate transfer of complete as-built files immediately upon occupancy by the Government. The Contractor shall retain a copy of the master, in order to continue to record any revisions which occur after submission of the master copy. Marked-up drawings shall show all as-built conditions made up to the time of the as-built submittal and shall reflect any changes, alterations adjustments or modifications resulting from approved shop drawings. An additional as-built submittal will be

necessary if additional revisions occur subsequent to the first as-built submittal. All additional revisions will be shown in a different color and will be submitted to the Government as soon as final as-built conditions are known

9.3 As-Built Conditions Which Are Different From The Contract Drawings. All as-built conditions which are different from the contract drawings shall be accurately reflected on each drawing. The as-built condition may be reflected by redrawing on every sheet which is impacted or by redrawing on one sheet and referring to that redrawn sheet on all other sheets that are impacted. If the as-built condition is accurately reflected on a shop drawing, then a copy of that shop drawing may be attached to the contract drawing with the corrections noted on that shop drawing with references to all other contract drawings where the as-built condition occurs. If the as-built condition is accurately reflected in a contract modification, then a copy of the modification sketch shall be attached to the contract drawing with the corrections noted on that sketch with references to all other contract drawings where the as-built condition occurs.

9.4 Additional As-Built Information That Exceeds The Detail Shown On The Contract Drawings. These as-built conditions include those that reflect structural details, foundation layouts, equipment, sizes, mechanical room layouts and other extensions of design, that were not shown in the original contract documents because the exact details were not known until after the time of approved shop drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the contract drawings. All such shop drawing submittals must include, along with the hard copy of the drawings, CADD files of the shop drawings in a commercially available digital format compatible with Intergraph's RLE raster format or Bentley Microstation Version 5 or later. All shop drawings which require submittal of CADD files are indicated in the submittal register located at the end of this section.

9.5 Underground Utilities. The as-built drawings shall indicate, in addition to all changes and corrections, the actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

9.6 Borrow Areas. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

9.7 Fire Protection Systems. If fire protection and fire detection related systems are included in this project, the as-built drawings will include detailed information for all aspects of the systems including wiring, piping, and equipment drawings.

15 June 1990

1 August 1996

(2) 10. EQUIPMENT DATA.

10.1 Real Property Equipment. The Contractor shall be required to make a list of all installed equipment furnished under this contract. This list shall

include all information usually listed on manufacturer's name plate. The RMS form is called INSTALLATION PROPERTY INFORMATION can be found in the RMS software. A copy of this form can be found at the end of the SPECIAL CONTRACT REQUIREMENTS. The list shall also include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, the following information shall be given: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. The list shall be furnished in electronic format in addition to hard paper copy. The list shall be furnished to the Contracting Officer not later than thirty (30) calendar days prior to completion of any segment of the contract work which has an incremental completion date.

10.2 Maintenance and Parts Data. The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication which will show detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph 10.1.

2 January 1996

11. PHYSICAL DATA (APR 1984) FAR 52.236-4. Data and information furnished or referred to below are furnished for the Contractor's information. The Government will not be responsible for any interpretation or conclusion drawn from the data or information by the Contractor.

11.1 Physical Conditions indicated on the drawings and in the specifications are the result of site investigations by surveys, borings, test pits and probings. Cores and soil samples from results of site investigations are available for inspection at various locations in the Louisville area, subject to prior arrangement at the Office of the District Engineer, Engineering Division, Steve Durrett, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky, 40201 (502) 582-5232.

11.2 Weather Conditions. The Contractor shall make his own investigations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being:

Louisville, Kentucky WSFO
NWS Forecast Office, NOAA
6201 Therlery Ln.
Louisville, Kentucky 40229
502-968-6025

Historical data for all areas may be obtained from:

U. S. Department of Commerce
National Climatic Center
Federal Building
Asheville, N. C. 28801

11.3 Transportation Facilities. Roads and railroads in the general area are shown on the drawings. Access ways shall be investigated by the Contractor to satisfy himself as to their existence and allowable use.

15 June 1990

12. UTILITIES (APR 1984) FAR 52.236-14 (Para. 12.1.1 & 12.1.2 only).

12.1 Availability and Use of Utility Services.

12.1.1 The Government will make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

12.1.2 The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

12.1.3 Electric Power for Small Tools not exceeding 20 amperes and 115 volts will be furnished from existing outlets at no cost to the Contractor, subject to proper use, and that total estimated consumption will not exceed 1,000 kilowatts per month. The Contractor's plan for use of small tools shall be submitted for determination of estimated consumption. In the event the estimate exceeds the above allowance, the requirements for other utilities will apply.

12.1.4 Drinking Water may be obtained from approved outlets on the post, and at no cost to the Contractor, subject to proper use.

12.1.5 Washing Facilities are not available.

12.1.6 Sanitary Facilities are not available.

12.2 Alterations to Utilities. Where changes and relocations of utility lines are noted to be performed by others, the Contractor shall give the Contracting Officer at least thirty (30) days written notice in advance of the time that the change or relocation is required. In the event that, after the expiration of thirty (30) days after the receipt of such notice by the Contracting Officer, such utility lines have not been changed or relocated and delay is occasioned to the completion of the work under contract, the Contractor will be entitled to a time extension equal to the period of time lost by the Contractor after the expiration of said thirty (30) day period. Any modification to existing or relocated lines required as a result of the Contractor's method of operation shall be made wholly at the Contractor's expense and no additional time will be allowed for delays incurred by such modifications.

12.3 Interruptions of Utilities:

12.3.1 No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

12.3.2 Request for Permission to shut down services shall be submitted in writing to the Contracting Officer not less than seventeen (17) days prior to date of proposed interruption. The request shall give the following information:

- (1) Nature of Utility (Gas, L.P. or H.P., Water, etc.)
- (2) Size of line and location of shutoff.
- (3) Buildings and services affected.
- (4) Hours and date of shutoff.
- (5) Estimated length of time services will be interrupted.

12.3.3 Services shall not be shutoff until receipt of approval of the proposed hours and date from the Contracting Officer.

12.3.4 Shutoffs which will cause interruption of Government work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the Using Agency without any additional cost to the Government.

12.3.5 Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

12.3.6 Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

13. NOT USED.

15 June 1990

(1) 14. LAYOUT OF WORK (APR 1984) FAR 52.236-17. The Contractor shall lay out its work from Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

15 June 1990

15. PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) FAR 52.236-1 (Para. 15 only). The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

15.1 For purposes of this paragraph "WORK BY THE CONTRACTOR" is defined as prime Contractor direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, equipment, or subcontractors. The "TOTAL AMOUNT OF WORK" is defined as total direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, or equipment.

15.2 Within 7 days after the award of any subcontract, either by himself or a subcontractor, the Contractor shall deliver to the Contracting Officer a completed SF 1413, "Statement and Acknowledgment." The form shall include the subcontractor's acknowledgement of the inclusion in his subcontract of the clauses of this contract entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act-Overtime Compensation," "Apprentices and Trainees," "Compliance with Copeland Regulations," "Withholding of Funds," "Subcontracts," "Contract Termination-Debarment," and "Payrolls and Basic Records." Nothing contained in this contract shall create any contractual relation between the subcontractor and the Government.

16. NOT USED.

24 February 1992

17. SUPERINTENDENCE OF SUBCONTRACTORS

17.1 The Contractor shall be required to furnish the following, in addition to the superintendence required by CONTRACT CLAUSE: SUPERINTENDENCE BY THE CONTRACTOR.

(1) If more than 50 percent and less than 70 percent of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70 percent or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

17.2 If the Contracting Officer, at any time after 50 percent of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirements for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

15 June 1990

18. IDENTIFICATION OF EMPLOYEES.

18.1 The Contractor shall be responsible for furnishing an identification badge/card to each employee prior to the employees work on-site, and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of the employee. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

18.2 The Contractor is required to provide a Local Agency Check for each individual that will be working on this contract. See Section 00800, Paragraph 38 for instructions.

24 February 1992

19. CONTRACTOR-PREPARED PROGRESS CHART

The progress chart to be prepared by the Contractor pursuant to the clause entitled "schedule for Construction Contracts" shall consists of a bar chart diagram with "s" curve.

15 January 1998

20. WARRANTY OF CONSTRUCTION (MAR 1984) ALTERNATE 1 (APR 1984) FAR 52.246-21I.

20.1 General Requirements.

20.1.1 In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 20.1.10 of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

20.1.1.1 Warranty Payment: Warranty work is a subsidiary portion of the contract work, and has a value to the Government approximating 1% of the contract award amount. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: Payments Under Fixed-Price Construction Contracts. If the Contractor fails to respond to warranty items as provided in paragraph 20.5, the Government may elect to acquire warranty repairs through other sources and, if so, shall backcharge the Contractor for the cost of such repairs. Such backcharges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

20.1.2 This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

(a) As a part of the one year warranty inspection, the Contracting Officer will conduct an infrared roof survey on any project involving a membrane roofing system. This survey will be conducted in accordance with ASTM C1153-90, "Standard Practice for the Location of Wet Insulation in Roofing Systems Using Infrared Imaging". In accordance with paragraph 20.1.3 and 20.1.4, the Contractor shall be required to replace all damaged materials and to locate and repair sources of moisture penetration.

20.1.3 The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

- (a) The Contractor's failure to conform to contract requirements; or
- (b) Any defect of equipment, material, workmanship, or design furnished.

20.1.4 The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

20.1.5 The Contracting Officer shall notify the Contractor, in writing, (see para. 20.2.3 and 20.5) within a reasonable time after the discovery of any failure, defect, or damage.

20.1.6 If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, (see para. 20.5) the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

20.1.7 With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(a) Obtain all warranties that would be given in normal commercial practice;

(b) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and

(c) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers with specific designation of their area of responsibilities if they are to be contacted directly on warranty corrections; and

(d) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

20.1.8 In the event the Contractor's warranty under paragraph 20.1.2 of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

20.1.9 Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

20.1.10 This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

20.1.11 Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

20.2 Performance Bond.

20.2.1 The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions.

20.2.2 In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

20.2.3 Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 20.5. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor as outlined in the paragraph 20.2.2 above.

MFG

MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by para. 20.1.

20.4.2 Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

20.4.3 Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS.

20.4.4 Equipment Warranty Tag Replacement. As stated in para. 20.1.4, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

20.5 Contractor's Response to Warranty Service Requirements.

20.5.1 Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below.

First Priority Code 1 Perform on site inspection to evaluate situation, determine course of action, initiate work within 24 hours and work continuously to completion or relief.

Second Priority Code 2 Perform on site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

Third Priority Code 3 All other work to be initiated within 5 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

Code 1 Air Traffic Control and Air Navigation Systems and Equipment.

Code 1 Air Conditioning System

- a. Hospital.
 - b. Buildings with computer equipment.
 - c. Commissary and Main PX.
 - d. Clubs.
 - e. Barracks, mess halls, BOQ/BEQ (entire building down).
 - f. Troop medical and dental.
- Code 2 Air Conditioning Systems
 - a. Recreational support.
 - b. Air conditioning leak in part of building, if causing damage.
 - c. Admin buildings with ADP equipment not on priority list.
- Code 1 Doors
 - a. Overhead doors not operational.
- Code 1 Electrical
 - a. Power failure (entire area or any building operational after 1600 hours).
 - b. Traffic control devices.
 - c. Security lights.
- Code 2 Electrical
 - a. Power failure (no power to a room or part of building).
 - b. Receptacle and lights.
 - c. Fire alarm systems.
- Code 1 Gas
 - a. Leaks and breaks.
 - b. No gas to family housing unit or cantonment area.
- Code 1 Heat
 - a. Hospital/Medical facilities.
 - b. Commissary and Main PX.
 - c. Clubs.
 - d. Area power failure affecting heat.
- Code 2 Heat
 - a. Medical storage.
 - b. Barracks.
- Code 1 Intrusion Detection Systems
 - Finance, PX and Commissary, and high security areas.
- Code 2 Intrusion Detection Systems
 - Systems other than those listed under Code 1.
- Code 1 Kitchen Equipment
 - a. Dishwasher.
 - b. All other equipment hampering preparation of a meal.
- Code 2 Kitchen Equipment
 - All other equipment not listed under Code 1.
- Code 2 Plumbing
 - a. Flush valves.
 - b. Fixture drain, supply line commode, or water pipe leaking.
 - c. Commode leaking at base.

Code 1 Refrigeration
 a. Commissary.
 b. Mess Hall.
 c. Cold Storage.
 d. Hospital.
 e. Medical storage.

Code 2 Refrigeration
 Mess hall - other than walk-in refrigerators and
 freezers.

Code 1 Roof Leaks
 Temporary repairs will be made where major damage to
 property is occurring.

Code 2 Roof Leaks
 Where major damage to property is not occurring, check
 for location of leak during rain and complete repairs
 on a Code 2 basis.

Code 1 Swimming Pools
 Chlorine leaks or broken pumps.

Code 1 Tank Wash Racks (Bird Baths)
 All systems which prevent tank wash.

Code 1 Water (Exterior)
 Normal operation of water pump station.

Code 2 Water (Exterior)
 No water to facility.

Code 1 Water, Hot (and Steam)
 a. Hospitals.
 b. Mess halls.
 c. BOQ, BEQ, barracks (entire building).
 d. Medical and dental.

Code 2 Water, Hot
 No hot water in portion of building listed under
 Code 1 (items a through c).

Code 1 Sprinkler System
 All sprinkler systems, valves, manholes, deluge
 systems, and air systems to sprinklers.

20.5.2 Should parts be required to complete the work and the parts are not immediately available the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractors proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce

the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

21. thru 27. NOT USED.

2 January 1991

28. IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY (APR 1984) FAR 52.245-3.

28.1 The Government will furnish to the Contractor the property identified in the Schedule to be incorporated or installed into the work or used in performing the contract. The listed property will be furnished at the place specified below. When the property is delivered, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer. The Contractor shall also report in writing to the Contracting Officer within 24 hours of delivery any damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract.

Location of FGP:

Ship steel for targets is available at Ames Range.

Existing crushed stone on roads and parking areas where indicated to be removed.

28.2 The Contractor is required to load and unload and transport the property to the jobsite at its own expense.

15 June 1990

29. AGGREGATE SOURCES.

29.1 General. Aggregates can be produced from the sources listed below.

(1) Kentucky Stone Co., Irvington, Kentucky, Ledges 1A, 2A, #a, 4A, and 20 to 22.

(2) Medusa Stone Company, Bardstown, Kentucky, Ledges 1T, 2T, 3 and 50'.

(3) Vulcan Materials Co., Elizabethtown, Kentucky, Plant #1, Ledges 1 through 7, about 50'.

(4) Quality Crushed Stone company, Shepherdsville, Kentucky, edges 1T, 1 through 8, about 100'.

(5) Bullitt County Stone Company, Shepherdsville, Kentucky, Ledges 1T, 1 through 8, about 100'.

(6) Mulzer Stone Company, Charlestown, Indiana, Ledges 1 through 5, about 70'.

29.2 Aggregates may be furnished from any of the above listed sources or at the option of the Contractor may be furnished from any other source designated by the Contractor and approved by the Contracting Officer, subject to the conditions hereinafter stated.

29.3 Source. After the award of the contract, the Contractor shall designate in writing only one source or one combination of sources from which he proposes to furnish aggregates. If the Contractor proposes to furnish aggregates from a source or from sources not listed above, he may designate only a single source or single combination of sources for aggregates. Samples for acceptance testing shall be provided as required by the technical portions of these specifications. If a source for coarse or fine aggregate so designated by the Contractor is not approved for use by the Contracting Officer, the Contractor may not submit for approval other sources, but shall furnish the coarse or fine aggregate, as the case may be, from a source listed above at no additional cost to the Government.

29.4 Listing of a concrete aggregate source is not to be construed as approval of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for concrete aggregate as determined by the Contracting Officer. Materials produced from an approved source shall meet all requirements of the technical portions of these specifications.

24 February 1992

30. NOT USED.

1 February 1995

(2) 31. PROJECT SIGN.

31.1 General. The Contractor shall furnish and erect at the location directed one project sign.

Exact placement location will be designated by the Contracting Officer. The panel sizes and graphic formats have been standardized for visual consistency throughout all Corps operations.

Panels are fabricated using HDO plywood with dimensional lumber uprights and bracing.

All legends are to be painted in the sizes and styles as specified by the graphic formats shown at the end of this section. The signs (including back and edges), posts and braces shall be given two coats of Benjamin Moore No. 120-60 poly-silicone enamel or approved equal before lettering. The 4' x 4' right section of the project sign shall be white with black lettering. The 2' x 4' left section shall be Communication Red (CR) with white lettering. Paint colors shall be as follow:

| | | |
|---------|-----------------------|--------------------|
| Black - | Federal Standard 595a | Color Number 27038 |
| White - | Federal Standard 595a | Color Number 27875 |
| Red - | PANTONE 032 | |

An example of the sign including mounting and fabrication details are also provided at the end of this section.

Name of the project shall be as follows:

Qualification Training Range
Fort Knox, Kentucky

Name of the designer shall be as follows:

Polyengineering, Inc.
Dothan, Alabama

31.2 Erection and Maintenance. The signs shall be erected at the designated location(s). Signs shall be plumb and backfill of post holes shall be well tamped to properly support the signs in position throughout the life of the contract. The signs shall be maintained in good condition until completion of the contract, shall remain the property of the Contractor, and shall be removed from the site upon completion of work under the contract.

31.3 The Corps of Engineers logo will be provided by the Contracting Officer.

31.4 Payment. No separate payment will be made for furnishing and erecting the project signs as specified and costs thereof shall be considered a subsidiary obligation of the Contractor.

32. NOT USED.

1 February 1995

33. WAGE RATES. The decision of the Secretary of Labor, covering rates of wages, including fringe benefits to be paid laborers and mechanics performing work under this contract, is attached hereto. The payment for all classes of laborers and mechanics actually employed to perform work under the contract will be specified in the following contract clauses: DAVIS-BACON ACT, CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, and THE COPELAND ACT.

Wage decisions included are:

KY980007 Building
KY980027 Heavy/Highway

34. NOT USED.

15 June 1990

35. INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY.

35.1 The Contractor at all times shall dispose his plant and conduct the work in such manner as to cause as little interference as possible with private and public travel. Damage (other than that resulting from normal wear and tear) to roads, shall be repaired to as good a condition as they were prior to the beginning of work and to the satisfaction of the Contracting Officer.

35.2 The Contractor shall provide and maintain as may be required by the State of Kentucky, Department of Transportation, proper barricades, fences, danger signals and lights, provide a sufficient number of watchmen, and take such other precautions as may be necessary to protect life, property and structures, and shall be liable for and hold the Government free and harmless from all damages occasioned in any way by his act or neglect, or that of his agents, employees, or workmen.

36. NOT USED.

1 August 1996

37. GOVERNMENT FIELD OFFICE FACILITIES AND SERVICES.

37.1 General. The field office will be set up at the location directed by the Contracting Officer. Underpinning shall be furnished and installed by the Contractor. Water and sewage disposal facilities shall be provided as specified in the technical portions of these specifications and shall be maintained by the Contractor for the duration of the contract. No separate payment will be made for maintaining the facilities and furnishing these

utilities and all costs in connection therein shall be included in other items authorized for payment. The buildings and facilities will be left in place upon completion of the contract. Temporary electric services shall be installed and maintained. Electric services to include meter and base.

37.2 Utility Services. The Contractor shall arrange for and pay all costs for water and port-a-pot as necessary for the field office. The existing equipment shall be cleaned and then serviced a minimum of biweekly.

37.3 Janitor Service. The Contractor shall furnish biweekly janitorial services, for the Government office and laboratory and perform normal maintenance of these facilities and grounds as deemed necessary by the Contracting Officer starting on or about July, 1997 and continuing for the life of the contract. The supply of all cleaning equipment and materials shall be the responsibility of the Contractor. Toilet facilities shall be kept clean and sanitary at all times. Toilet paper, hand soap, paper towels, and other materials the Contracting Officer determines necessary to provide sanitary facilities shall be furnished by the Contractor. Services shall be performed at such a time and in such a manner to least interfere with the operations, but will be accomplished during normal working hours. Services shall be accomplished to the satisfaction of the Contracting Officer. The Contractor shall also provide daily trash collection and clean-up of the Government buildings and adjacent outside areas, snow and ice removal from office and parking areas, and mowing of grass at least weekly in season, and shall dispose of all discarded debris, aggregate samples and concrete test samples, all in manner approved by the Contracting Officer.

37.4 Payment. No separate payment will be made for these Contractor-furnished services, and all costs thereof shall be incidental to the various bid items of the contract.

1 August 1996

38. COMPLIANCE WITH POST/BASE REGULATIONS. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control and traffic regulations, shall be observed by the Contractor. Information regarding these requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities.

38.1 Contractor personnel shall park only in areas authorized by the Contracting Officer.

38.2 The Contractor shall provide a Seven Day Notice to the Contracting Officer, in writing, before required soil treatment agents are applied, to assure that DOD Certified Pest Control Personnel are present during soil treatment applications. All soil treatment applications must be in the presence of DOD Certified Pest Control personnel.

20 March 1997

39. EQUIPMENT AND OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995) EFAR 52.231-5000.

39.1 This does not apply to terminations. See 52.249,5000, Basis for Settlement of Proposals and FAR Part 49.

39.2 Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting

records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region II. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time of negotiations shall apply.

39.3 Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

39.4 When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the Contracting Officer shall request the Contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Cover Sheet.

39.5 Whenever a modification or equitable adjustment of contract price is required, the contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of SPECIAL CONTRACT REQUIREMENT: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. A copy of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the office of the District Engineer, Room 821, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky, or a copy may be ordered from the Government Printing Office at a cost of \$11.00 by calling telephone no. (301) 953-7974.

Address to Order: U.S. Government Printing Office
Document Warehouse
8160 Cherry Lane
Laurel, MD 20707

| Vol No. | Stock No. |
|---------|-----------------|
| 1 | 008-022-00254-5 |
| 2 | 008-022-00255-3 |
| 3 | 008-022-00256-1 |
| 4 | 008-022-00257-0 |
| 5 | 008-022-00258-8 |
| 6 | 008-022-00259-6 |
| 7 | 008-022-00260-0 |
| 8 | 008-022-00261-8 |
| 9 | 008-022-00262-6 |
| 10 | 008-022-00263-4 |
| 11 | 008-022-00264-2 |
| 12 | 008-022-00265-1 |

15 June 1990

40. LABOR, EQUIPMENT, AND MATERIAL REPORTS.

40.1 Daily Equipment Report. The Contractor shall submit a daily report of all Contractor-owned or rented equipment at the jobsite. A similar report is required for all subcontractor equipment. The subcontractor's report may be separate or included with the Contractor's report provided the equipment is adequately identified as to ownership. The required equipment report shall include each item of equipment (hand-operated small tools or equipment excluded) on the job and shall specifically identify each item as to whether it is Contractor-owned or rented, shifts, hours of usage, downtime for repairs, and standby time. Identification of the equipment shall include make, model and plant number of all items. Separate identification by a key sheet providing these data may be utilized with the daily report indicating the type of equipment and the equipment plant numbers. The format of the Daily Equipment Report will be as approved by the Government in the field.

40.2 Labor, Equipment & Material Reports for Extra Work/Cost. A Report shall also be submitted by the Contractor listing any labor, equipment and materials expended on and/or impacted by any change order directed by the Government and for which total price/time agreement has not been reached. These requirements also apply to subcontractors at any tier. The same Report is required at any time the Contractor claims or intends to claim for extra costs whether or not there is Government recognition (constructive changes). This requirement is in addition to any Contractor "Notice" or "Reservation of Rights". Submittal of such a report will not be construed as satisfying the "Notice" required under the "Changes" clause or any other clause. But, absence of such Reports submitted to the Government contemporaneously with the alleged extra work/cost will be considered as evidence that no such extra work/cost occurred that are chargeable to the Government.

40.3 The Report shall be detailed to the degree required by the Government in the field and shall contain the following as a minimum:

- a. The cause of the extra labor, equipment or materials costs.
- b. For extra labor - Indicate crew, craft, hours, location and cost. Describe nature or type of extra costs, i.e, extra work, overtime, acceleration, interference, reassignment, mobilizations and demobilizations, supervision, overhead, type of inefficiency, etc.
- c. For extra equipment - Indicate type and description, hours, location, cost; whether working, idle, standby, under repair, extra work involved, etc.
- d. For extra materials - Indicate type and description, where used, whether consumed, installed or multi-use, quantity, cost, extra work involved, etc.
- e. Affected activities - Relate to Contract Schedule (Network Analysis); demonstrate whether delay or suspension is involved.
- f. Segregate all entries by prime and each subcontractor.
- g. Summarize costs daily and by cumulative subtotal or with frequency required by the Government.

40.4 This Report will not be considered as evidence that any of the alleged extra costs actually occurred. The Report will be used to check against over obligation of funds for change orders directed prior to price/time agreement and to track alleged extra costs the Contractor considers otherwise chargeable against the Government. The Government may respond at any interval to either challenge, amend or confirm the Report. Absence of a Government response is not to be considered acquiescence or denial. The Government may

order work stoppage if deemed necessary to avoid overobligation of funds. The frequency of the report shall be daily or as otherwise approved by the Government representative in writing.

41. NOT USED.

24 January 1994

(1) 42. PROGRESS PHOTOGRAPHS. The Contractor shall, during the progress of the work, furnish the Contracting Officer photographs, slides and negatives depicting construction progress. The photographic work furnished shall be commercial quality as determined by the Contracting Officer. The photography shall be performed between the first and fifth of each month and the photographs, slides and negatives delivered to the Contracting Officer not later than the 15th of each month taken. A maximum of six views from different positions shall be taken as directed to show, inasmuch as possible, work accomplished during the previous month. At least, one set of photographs, slides and negatives will be made at completion of the contract, after final inspection by the Contracting Officer. For work extending over considerable area or length, such as road construction and timber clearing, aerial photographs shall be furnished periodically, at least on alternate months, in lieu of conventional photographs. The photographs shall be 8"x10" color prints and the slides 35 mm color. Each photograph and slide shall be identified on the face of the picture or the border of the slide giving date made, contract title and number, location of work, as well as a brief description of work depicted. Each negative will be identified with the same information on a sheet of paper by cross-referencing to the number on the negative. Two copies of photographs and slides, along with the original negatives of each view taken, shall be furnished to the Contracting Officer by the time stipulated above. No separate payment will be made for these services and all costs in connection thereto shall be considered a subsidiary obligation of the Contractor.

20 March 1997

43. PAYMENT FOR MATERIALS DELIVERED OFFSITE. (MAR 1995) EFARS 52.232-5000.

43.1 Pursuant to CONTRACT CLAUSE: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS, materials delivered to the Contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the CONTRACT CLAUSES are fulfilled. Payment for items delivered to locations other than the worksite will be limited to:

(1) Materials required by the technical provisions,

(2) Materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

43.2 Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contract and including the value of material and labor incorporated into the item.

44. NOT USED.

17 July 1992

45. INSURANCE--WORK ON A GOVERNMENT INSTALLATION (SEP 1989) FAR 52.228-5.

45.1 The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(1) Coverage complying with State laws governing insurance requirements, such as those requirements pertaining to Workman's Compensation and Occupational Disease Insurance. Employer's Liability Insurance shall be furnished in limits of not less than \$100,000.00 except in states with exclusive or monopolistic funds.

(2) Comprehensive General Liability Insurance for bodily injury coverage shall be furnished in limits of not less than \$500,000 per occurrence.

(3) Comprehensive Automobile Liability Insurance for both bodily injury and property damage, shall be furnished in limits of not less than \$200,000.00 per person, \$500,000.00 per accident for bodily injury, and \$20,000.00 per accident for property damage. When the Financial Responsibility or Compulsory Insurance Law of the State, requires higher limits, the policy shall provide for coverage of at least those higher limits.

45.2 Before commencing work under this contract, the Contractor shall certify to the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

45.3 The Contractor shall insert the substance of this clause, including this paragraph (45.3), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

1 August 1996

46. IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM

46.1 The Contractor shall utilize a Government furnished software program titled, "RMS" (Resident Management System) to maintain critical information needed to manage the project. RMS produces up-to-date management and analysis reports as well as a majority of the forms required in this contract for submission to the Government. Some of these forms are shown as samples at the end of this section. They include ENG 4288 (Submittal Register), ENG 4025 (Transmittal form), CQC Daily Report, Transfer Property Information Form, Definable Feature of Work Form, User Schooling Information Form, Quality Control Testing Information, and Installed Property Information Form.

46.2 The following hardware and software are needed by the Contractor to run RMS: a personal computer with 80386 process (or higher) and four megabytes (MB) or more of random access memory (RAM) and a 3 1/2 inch high density floppy drive. Also needed is a HP Laser Jet Series II, III, IV or V printer, a color monitor, MS-DOS, version 5.0 or later, Word Perfect, version 5.1 or later, and Computer files = 81.

46.3 Once the Contract is awarded, the Contractor will be given a cop of the RMS program for implementation. A meeting between the Government and the Contractor will be arranged to inform the Contractor on the use of the software

package which is similar to the one the Government will use to manage the project. File updates will be transferred to the Government by disk on a weekly basis, unless electronic transfers are agreed on.

47. NOT USED.

15 June 1990

48. DEFINITIONS. The following provision is applicable to the SPECIFICATIONS, of this solicitation: The term GENERAL PROVISIONS shall mean CONTRACT CLAUSES, the terms SPECIAL PROVISIONS and SPECIAL CLAUSES shall mean SPECIAL CONTRACT REQUIREMENTS.

49. NOT USED.

2 January 1991

50. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. ER 415-1-15 (31 OCT 89)

50.1 This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: Fixed Price Construction)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

50.1.1 The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

50.1.2 The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

50.2 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

| JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|------|------|------|------|------|------|------|------|------|------|------|------|
| (11) | (08) | (06) | (06) | (05) | (04) | (05) | (04) | (04) | (04) | (04) | (06) |

50.3 Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 50.2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)".

1 August 1996

51. NOT USED.

4 June 1993

52. USE OF INCLINOMETER FOR LONG BED DUMP TRUCKS (DACF BULLETIN 25 MARCH 1993) The recommendation of EM 385-1-1, Section 16.B.15, is mandatory for this project.

20 March 1997

53. AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1). As covered by CONTRACT CLAUSE "ACCIDENT PREVENTION", compliance with EM 385-1-1 is a requirement for this contract. Copies may be purchased for \$31.00 each at the following address:

United States Government Bookstore
Room 118, Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222
Telephone: (412) 644-2721
FAX: (412) 644-4547

15 April 1991

54. FIRE PROTECTION DURING CONSTRUCTION (MIL-HDBK-1008b Para. 2.9.2) The Contractor is alerted to the requirements of Contract Clause "CLEANING UP" and more specifically to the requirements for fire protection during construction spelled out in EM 385-1-1 and NFPA No. 241 Building Construction and Demolition Operations. This item must be covered in the submittal required under Contract Clause "ACCIDENT PREVENTION".

2 Jan 1996

55. HAUL ROADS

55.1 Whenever practical, one-way haul roads shall be used on this contract. Haul roads built and maintained for this work shall comply with the following:

55.1.1 One-way haul roads for off-the road equipment; e.g., belly dumps, scrapers, and off-the-road trucks shall have a minimum usable width of 25 ft. One-way haul roads for over-the-road haulage equipment only (e.g., dump trucks, etc.) may be reduced to a usable width of 15 ft. When the Contracting Officer determines that it is impractical to obtain the required width for one-way haul roads (e.g., a road on top of a levee), a usable width of not less than 10 ft. may be approved by the Contracting Officer, provided a positive means of traffic control is implemented. Such positive means shall be signs, signals, and/or signalman and an effective means of speed control.

55.1.2 Two-way haul roads for off-the-road haulage equipment shall have a usable width of 60 ft. Two-way haul roads for over-the-road haulage equipment only may be reduced to a usable width of 30 ft.

55.1.3 Haul roads shall be graded and otherwise maintained to keep the surface free from potholes, ruts, and similar conditions that could result in unsafe operation.

55.1.4 Grades and curves shall allow a minimum sight distance of 200 ft. for one-way roads and 300 ft. for two-way roads. Sight distance is defined as the centerline distance an equipment operator (4.5 ft. above the road surface) can see an object 4.5 ft. above the road surface. When conditions make it impractical to obtain the required sight distance (e.g., ramps over levees), a positive means of traffic control shall be implemented.

55.1.5 Dust abatement shall permit observation of objects on the roadway at a minimum distance of 300 ft.

55.1.6 Haul roads shall have the edges of the usable portion marked with posts at intervals of 50 ft. on curves and 200 ft. maximum elsewhere. Such markers shall extend 6 ft. above the road surface and, for nighttime haulage, be provided with reflectors in both directions.

13 March 1996

56. RADIOACTIVE MATERIAL/EQUIPMENT

All equipment (e.g. nuclear density gauges) or items containing radioactive material brought onto Fort Knox must be licensed by the Nuclear Regulatory Commission, and a DA Authorization (DARA) or Permit (DARP) secured. Fort Knox is considered a non-agreement site with respect to reciprocity with State permits; an NRC Form 241 must be obtained for each contract. Contractors must submit a DA Form 3337, "Application for Department of the Army Radiation Authorization or Permit", to the Fort Knox Safety Office before a DARA or a DARP can be obtained. A minimum of 45 days is required to process the DARA/DARP.

The Ft. Knox Safety Office can provide a waiver of the DARA/DARP for 15 calendar days. A proper NRC Form 241 and a current radioactive material license must be provided to secure a waiver.

57. NOT USED.

1 November 1991

58. CONSTRUCTION HAZARD COMMUNICATION. The Contractor is required to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1926.59). This standard is designed to inform workers of safe and appropriate methods of working with hazardous substances in the workplace. The standard has five requirements, and every hazardous or potentially hazardous substance used or stored in the work area is subject to all five. They are:

(1) Hazard Evaluation. Any company which produces or imports a chemical or compound must conduct a hazard evaluation of the substance to determine its potential health or physical hazard. The hazard evaluation consists of an investigation of all the available scientific evidence about the substance. The Contractor is required to assure that all producers (manufacturer/distributors) have performed these evaluations and transmit the required information with any hazardous materials being used or stored on the project site. From the hazard evaluation, a substance may be classified as a health hazard, or a physical hazard. These classifications are then further broken down according to type:

Health Hazards

Carcinogens
Irritants
Sensitizers
Corrosives
Toxic substances
Highly toxic substances
Substances harmful to specific organs or parts of the body

Physical Hazards

Combustible liquids
Compressed gases
Explosives
Flammables
Organic peroxides
Unstable substances
Water-reactive substances

(2) Warning Labels. If a chemical is hazardous or potentially hazardous, the producer or importer must affix a warning label to every container of that

chemical before it leaves his facility. The Contractor must assure these labels are attached and legible. The label must identify the chemical, state the hazard, and give the name and address of the producer or importer. If the hazardous substance is transferred to another container, that container must then be labeled, tagged, or marked with the name of the chemical and the appropriate hazard warning. Warning labels should be replaced immediately if they are defaced or removed.

(3) Material Safety Data Sheets. The producer or importer must also supply a material safety data sheet (MSDS). The Contractor must keep these available in the work area where the substance is used, so that the people using the substance can easily review important safety and health information, such as:

The hazard possible from misuse of the substance
Precautions necessary for use, handling, and storage
Emergency procedures for leaks, spills, fire and first aid
Useful facts about the substance's physical or chemical properties

(4) Work Area Specific Training. Because of hazardous substance may react differently depending on how it is used or the environment of the work area, the Contractor must conduct work area specific training; special training which takes the Contractor's operations, environment, and work policies into consideration. Work area training presents:

The hazardous substances which are present in the work place and the hazards they pose

Ways to protect against those hazards, such as protective equipment, emergency procedures, and safe handling

Where the MSDS's are kept, and an explanation of the labeling system
Where the Contractor's written Hazard Communication Program is located

(5) The Written Hazard Communication Program. In accordance with OSHA requirements, the Contractor must prepare a written Hazard Communication Program. This document will be included in the Contractor's Accident Prevention Plan. This document states how the Contractor plans to ensure that hazardous materials are appropriately labeled, how and where MSDS's will be maintained, and how employees will be provided with specific information and training.

15 June 1990

59. CORPS OF ENGINEERS PLAQUE. At the location directed by the Contracting Officer, the Contractor shall mount a Government furnished plaque. Mounting shall be with expansion bolts and rosettes. A photostatic copy of this plaque is bound at the end of these SPECIAL CONTRACT REQUIREMENTS.

60. NOT USED.

24 FEBRUARY 1992

61. MECHANICAL ROOM LAYOUT (ORL). Detailed mechanical room layout drawings shall be submitted for approval in accordance with SD-04 Section 01330. Layout drawings shall show location and maintenance clearances for all mechanical room equipment, and all utility runs/chases for mechanical, electrical, telephone and other similar systems. Drawings shall be submitted at the same time as the submittals for the equipment to be located within the mechanical room.

20 March 1997

62. RIGHTS IN TECHNICAL DATA--NONCOMMERCIAL ITEMS (NOV 1995)

252.227-7013 (JUN 1995).

(a) Definitions. As used in this clause:

(1) "Computer data base" means a collection of data recorded in a form capable of being processed by a computer. The term does not include computer software.

(2) "Computer program" means a set of instructions, rules, or routines recorded in a form that is capable of causing a computer to perform a specific operation or series of operations.

(3) "Computer software" means computer programs, source code, source code listings, object code listings, design details, algorithms, processes, flow charts, formulae and related material that would enable the software to be reproduced, recreated, or recompiled. Computer software does not include computer data bases or computer software documentation.

(4) "Computer software documentation" means owner's manuals, user's manuals, installation instructions, operating instructions, and other similar items, regardless of storage medium, that explain the capabilities of the computer software or provide instructions for using the software.

(5) "Detailed manufacturing or process data" means technical data that describe the steps, sequences, and conditions of manufacturing, processing or assembly used by the manufacturer to produce an item or component or to perform a process.

(6) "Developed" means that an item, component, or process exists and is workable. Thus, the item or component must have been constructed or the process practiced. Workability is generally established when the item, component, or process has been analyzed or tested sufficiently to demonstrate to reasonable people skilled in the applicable art that there is a high probability that it will operate as intended. Whether, how much, and what type of analysis or testing is required to establish workability depends on the nature of the item, component, or process, and the state of the art. To be considered "developed," the item, component, or process need not be at the stage where it could be offered for sale or sold on the commercial market, nor must the item, component, or process be actually reduced to practice within the meaning of Title 35 of the United States Code.

(7) "Developed exclusively at private expense" means development was accomplished entirely with costs charged to indirect cost pools, costs not allocated to a government contract, or any combination thereof.

(i) Private expense determinations should be made at the lowest practicable level.

(ii) Under fixed-priced contracts, when total costs are greater than the firm-fixed-price or ceiling price of the contract, the additional development costs necessary to complete development shall not be considered when determining whether development was at government, private, or mixed expense.

(8) "Developed exclusively with government funds" means development was not accomplished exclusively or partially at private expense.

(9) "Developed with mixed funding" means development was accomplished partially with costs charged to indirect cost pools and/or costs not allocated to a government contract, and partially with costs charged directly to a government contract.

(10) "Form, fit, and function data" means technical data that describes the required overall physical, functional, and performance characteristics (along with the qualification requirements, if applicable) of an item, component, or process to the extent necessary to permit identification of physically and functionally interchangeable items.

(11) "Government purpose" means any activity in which the United States Government is a party, including cooperative agreements with international or multi-national defense organizations, or sales or transfers by the United States Government to foreign governments or international organizations. Government purposes include competitive procurement, but do not include the rights to use, modify, reproduce, release, perform, display, or disclose technical data for commercial purposes or authorize others to do so.

(12) "Government purpose rights" means the right to--

(i) Use, modify, reproduce, release, perform, display, or disclose technical data within the Government without restrictions; and

(ii) Release or disclose technical data outside the Government and authorize persons to whom release or disclosure has been made to use, modify, reproduce, release, perform, display, or disclose that data for United States government purposes.

(13) "Limited rights" means the rights to use, modify, reproduce, release, perform, display, or disclose technical data, in whole or in part, within the Government. The Government may not, without the written permission of the party asserting limited rights, release or disclose the technical data outside the Government, use the technical data for manufacture, or authorize the technical data to be used by another part, except that the Government may reproduce, release or disclose such data or authorize the use or reproduction of the data by persons outside the Government if reproduction, release, disclosure, or use is--

(i) Necessary for emergency repair and overhaul; or

(ii) A release or disclosure of technical data (other than detailed manufacturing or process data) to, or use of such data by, a foreign government that is in the interest of the Government and is required for evaluational or informational purposes;

(iii) Subject to a prohibition on the further reproduction, release, disclosure, or use of the technical data; and

(iv) The contractor or subcontractor asserting the restriction is notified of such reproduction, release, disclosure, or use.

(14) "Technical data" means recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include computer software or data incidental to contract administration, such as financial and/or management information.

(15) "Unlimited rights" means rights to use, modify, reproduce, perform, display, release, or disclose technical data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so.

(b) Rights in technical data.

The Contractor grants or shall obtain for the Government the following royalty free, world-wide, nonexclusive, irrevocable license rights in technical data other than computer software documentation (see Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation clause of this contract for rights in computer software documentations):

(1) Unlimited rights.

The Government shall have unlimited rights in technical data that are--

(i) Data pertaining to an item, component, or process which has been or will be developed exclusively with Government funds;

(ii) Studies, analyses, test data, or similar data produced for this contract, when the study, analysis, test, or similar work was specified as an element of performance;

(iii) Created exclusively with Government funds in the performance of a contract that does not require the development, manufacture, construction, or production of items, components, or processes;

(iv) Form, fit, and function data;

(v) Necessary for installation, operation, maintenance, or training purposes (other than detailed manufacturing or process data);

(vi) Corrections or changes to technical data furnished to the Contractor by the Government;

(vii) Otherwise publicly available or have been released or disclosed by the Contractor or subcontractor without restrictions on further use, release or disclosure, other than a release or disclosure resulting from the sale, transfer, or other assignment of interest in the technical data to another party or the sale or transfer of some or all of a business entity or its assets to another party;

(viii) Data in which the Government has obtained unlimited rights under another Government contract or as a result of negotiations; or

(ix) Data furnished to the Government, under this or any other Government contract or subcontract thereunder, with--

(A) Government purpose license rights or limited rights and the restrictive condition(s) has/have expired; or

(B) Government purpose rights and the Contractor's exclusive right to use such data for commercial purposes has expired.

(2) Government purpose rights.

(i) The Government shall have government purpose rights for a five-year period, or such other period as may be negotiated, in technical data--

(A) That pertain to items, components, or processes developed with mixed funding except when the Government is entitled to unlimited rights in such data as provided in paragraphs (b)(ii) and (b)(iv) through (b)(ix) of this clause; or

(B) Created with mixed funding in the performance of a contract that does not require the development, manufacture, construction, or production of items, components, or processes.

(ii) The five-year period, or such other period as may have been negotiated, shall commence upon execution of the contract, subcontract, letter contract (or similar contractual instrument), contract modification, or option exercise that required development of the items, components, or processes or creation of the data described in paragraph (b)(2)(i)(B) of this clause. Upon expiration of the five-year or other negotiated period, the Government shall have unlimited rights in the technical data.

(iii) The Government shall not release or disclose technical data in which it has government purpose rights unless--

(A) Prior to release or disclosure, the intended recipient is subject to the non-disclosure agreement at 227.7103-7 of the Defense Federal Acquisition Regulation Supplement (DFARS); or

(B) The recipient is a Government contractor receiving access to the data for performance of a Government contract that contains the clause at DFARS 252.227-7025, Limitations on the Use or Disclosure of Government-Furnished Information Market with Restrictive Legends.

(iv) The Contractor has the exclusive right, including the right to license others, to use technical data in which the Government has obtained government purpose rights under this contract for any commercial purpose during the time period specified in the government purpose rights legend prescribed in paragraph (f)(2) of this clause.

(3) Limited rights.

(i) Except as provided in paragraphs (b)(1)(ii) and (b)(1)(iv) through (b)(1)(ix) of this clause, the Government shall have limited rights in technical data--

(A) Pertaining to items, components, or processes developed exclusively at private expense and marked with the limited rights legend prescribed in paragraph (f) of this clause; or

(B) Created exclusively at private expense in the performance of a contract that does not require the development, manufacture, construction, or production of items, components, or processes.

(ii) The Government shall require a recipient of limited rights data for emergency repair or overhaul to destroy the data and all copies in its possession promptly following completion of the emergency repair/overhaul and to notify the Contractor that the data have been destroyed.

(iii) The Contractor, its subcontractors, and suppliers are not required to provide the Government additional rights to use, modify, reproduce, release, perform, display, or disclose technical furnished to the Government with limited rights. However, if the Government desires to obtain additional rights in technical data in which it has limited rights, the Contractor agrees to promptly enter into negotiations with the Contracting Officer to determine whether there are acceptable terms for transferring such rights. All technical data in which the Contractor has granted the Government additional rights shall be listed or described in a license agreement made part of the contract. The license shall enumerate the additional rights granted the Government in such data.

(4) Specifically negotiated license rights.

The standard license rights granted to the Government under paragraphs (b)(1) through (b)(3) of this clause, including the period during which the Government shall have government purpose rights in technical data, may be modified by mutual agreement to provide such rights as the parties consider appropriate but shall not provide the Government lesser rights than are enumerated in paragraph (a)(13) of this clause. Any rights so negotiated shall be identified in a license agreement made part of this contract.

(5) Prior government rights.

Technical data that will be delivered, furnished, or otherwise provided to the Government under this contract, in which the Government has previously obtained rights shall be delivered, furnished, or provided with the pre-existing rights, unless--

(i) The parties have agreed otherwise; or

(ii) Any restrictions on the Government's rights to use, modify, reproduce, release, perform, display, or disclose the data have expired or no longer apply.

(6) Release from liability.

The Contractor agrees to release the Government from liability for any release or disclosure of technical data made in accordance with paragraph (a)(13) or (b)(2)(iii) of this clause, in accordance with the terms of a license negotiated under paragraph (b)(4) of this clause, or by others to whom the recipient has released or disclosed the data and to seek relief solely from the party who has improperly used, modified, reproduced, released, performed, displayed, or disclosed Contractor data marked with restrictive legends.

(c) Contractor rights in technical data.

All rights not granted to the Government are retained by the Contractor.

(d) Third party copyrighted data.

The Contractor shall not, without the written approval of the Contracting Officer, incorporate any copyrighted data in the technical data to be delivered under this contract unless the Contractor is the copyright owner or has obtained for the Government the license rights necessary to perfect a license or licenses in the deliverable data of the appropriate scope set forth in paragraph (b) of this clause, and has affixed a statement of the license or licenses obtained on behalf of the Government and other persons to the data transmittal document.

(e) Identification and delivery of data to be furnished with restrictions on use, release, or disclosure.

(1) This paragraph does not apply to restrictions based solely on copyright.

(2) Except as provided in paragraph (e)(3) of the clause, technical data that the Contractor assets should be furnished to the Government with restrictions on use, release, or disclosure are identified in an attachment to this contract (see Attachment). The Contractor shall not deliver any data with restrictive markings unless the data are listed on the Attachment.

(3) In addition to the assertions made in the Attachment, other assertions may be identified after award when based on new information or inadvertent omissions unless the inadvertent omissions would have materially affected the source selection decision. Such identification and assertion shall be submitted to the Contracting Officer as soon as practicable prior to the scheduled date for delivery of the data, in the following format, and signed by an official authorized to contractually obligate the Contractor:

Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data.

The Contractor asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data should be restricted--

| Technical Data to be Furnished With Restrictions* | Basis for Assertion** | Asserted Rights Category*** | Name of Person Asserting Restrictions**** |
|---|--------------------------|-----------------------------------|---|
| (LIST) | (LIST) | (LIST) | (LIST) |

*If the assertion is applicable to items, components, or processes developed at private expense, identify both the data and each such item, component, or process.

**Generally, the development of an item, component, or process at private expense, either exclusively or partially, is the only basis for asserting restrictions on the Government's rights to use, release, or disclose technical data pertaining to such terms, components, or processes. Indicate whether development was exclusively or partially at private expense. If development was not at private expense, enter the specific reason for asserting that the Government's right should be restricted.

***Enter asserted rights category (e.g. government purpose license rights from a prior contract, rights in SBIR data generated under another contract, limited or government purpose rights under this or a prior contract, or specifically negotiated licenses).

****Corporation, individual, or other person, as appropriate.

Date _____

Printed Name and Title _____

Signature _____

(End of identification and assertion)

(4) When requested by the Contracting Officer, the Contractor shall provide sufficient information to enable the Contracting Officer to evaluate the Contractor's assertions. The Contracting Officer reserves the right to add the Contractor's assertions to the Attachment and validate any listed assertion, at a later date, in accordance with the procedures of the Validation of Restrictive Markings on Technical Data clause of this contract.

(f) Marking requirements.

The Contractor, and its subcontractor or suppliers, may only assert restrictions on the Government's rights to use, modify, reproduce, release, perform, display, or disclose technical data to be delivered under this contract by marking the deliverable data subject to restriction. Except as provided in paragraph (f)(5) of this clause, only the following legends are authorized under this contract: the government purpose rights legend at paragraph (f)(2) of this clause: the limited rights legend at paragraph (f)(3) of this clause: or the special license rights legend at paragraph (f)(4) of this clause, and/or a notice of copyright as prescribed under 17 U.S.C. 401 or 402.

(1) General marking instructions.

The Contractor, or its subcontractors or suppliers, shall conspicuously and legibly mark the appropriate legend on all technical data that qualify for such markings. The authorized legends shall be placed on the transmittal document or storage container and, for printed material, each page of the printed material containing technical data for which restrictions are asserted. When only portions of a page of printed material are subject to the asserted restrictions, such portions shall be identified by circling, underscoring, with a note, or other appropriate identifier. Technical data transmitted directly from one computer or computer terminal to another shall contain a notice of asserted restrictions. Reproductions of technical data or any portions thereof subject to asserted restrictions shall also reproduce the asserted restrictions.

(2) Government purpose rights markings.

Data delivered or otherwise furnished to the Government with government purpose rights shall be marked as follows:

GOVERNMENT PURPOSE RIGHTS

Contract No. _____

Contractor Name _____

Contractor Address _____

Expiration Date _____

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these technical data are restricted by paragraph (b)(2) of the Rights in Technical Data--Noncommercial Items clause contained in the above identified contract. No restrictions apply after the expiration date shown above. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings.

(End of legend)

(3) Limited rights markings.

Data delivered or otherwise furnished to the Government with limited rights shall be marked with the following legend:

LIMITED RIGHTS

Contract No. _____

Contractor Name _____

Contractor Address _____

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these technical data are restricted by paragraph (b)(3) of the Rights in Technical Data--Noncommercial Items clause contained in the above identified contract. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings. Any person, other than the Government, who has been provided access to such data must promptly notify the above name Contractor.

(End of legend)

(4) Special license rights markings.

(I) Data in which the Government's rights stem from a specifically negotiated license shall be marked with the following legend:

SPECIAL LICENSE RIGHTS

The Government's rights to use, modify, reproduce, release, perform, display, or disclose these data are restricted by Contract No. _____)Insert contract number) _____, License No. _____ (Insert license identifier) _____. Any reproduction of technical data or portions thereof marked with this legend must also reproduce the markings.

(End of legend)

(ii) For purposes of this clause, special licenses do not include government purpose license rights acquired under a prior contract (see paragraph (b)(5) of this clause)_.

(5) Pre-existing data markings.

If the terms of a prior contract or license permitted the Contractor to restrict the Government's rights to use, modify, reproduce, release perform, display, or disclose technical data deliverable under this contract, and those restrictions are still applicable, the Contractor may mark such data with the appropriate restrictive legend for which the data qualified under the prior contract or license. The marking procedures in paragraph (f)(1) of this clause shall be followed.

(g) Contractor procedures and records.

Throughout performance of this contract, the Contractor and its subcontractors or suppliers that will deliver technical data with other than unlimited rights, shall--

(1) Have, maintain, and follow written procedures sufficient to assure that restrictive markings are used only when authorized by the terms of this clause, and

(2) Maintain records sufficient to justify the validity of any restrictive markings on technical data delivered under this contract.

(h) Removal of unjustified and nonconforming markings.

(1) Unjustified technical data markings.

The rights and obligations of the parties regarding the validation of restrictive markings or technical data furnished or to be furnished under this contract are contained in the Validation of Restrictive Markings on Technical Data clause of this contract. Notwithstanding any provision of this contract concerning inspection and acceptance, the Government may ignore or, at the Contractor's expense, correct or strike a marking if, in accordance with the procedures in the Validation of Restrictive Markings on Technical Data clause of this contract, a restrictive marking is determined to be unjustified.

(2) Nonconforming technical data markings.

A nonconforming marking is a marking placed on technical data delivered or otherwise furnished to the Government under this contract that is not in the format authorized by this contract. Correction of nonconforming markings is not subject to the Validation of Restrictive Markings on Technical Data clause of this contract. If the Contracting Officer notifies the Contractor of a nonconforming marking and the Contractor fails to remove or correct such marking within sixty (60) days, the Government may ignore or, at the Contractor's expense, remove or correct any nonconforming marking.

(I) Relation to patents.

Nothing contained in this clause shall imply a license to the Government under any patent or be construed as affecting the scope of any license or other with otherwise granted to the Government under any patent.

(j) Limitation on charges for rights in technical data.

(1) The Contractor shall not charge to this contract any cost, including, but not limited to, license fees, royalties, or similar charges, for rights in technical data to be delivered under this contract when--

(I) The Government has acquired, by any means, the same or greater rights in the data; or

(ii) The data are available to the public without restrictions.

(2) The limitation in paragraph (j)(1) of this clause--

(I) Includes costs charged by a subcontractor or supplier, at any tier, or costs incurred by the Contractor to acquire rights in subcontractor or supplier technical data, if the subcontractor or supplier has been paid for such rights under any other Government contract or under a license conveying the rights to the Government; and

(ii) Does not include the reasonable costs of reproducing, handling, or mailing the documents or other media in which the technical data will be delivered.

(k) Applicability to subcontractors or suppliers.

(1) The Contractor shall ensure that the rights afforded its subcontractors and suppliers under 10 U.S.C. 2320, 10 U.S.C. 2321, and the

identification, assertion, and delivery processes of paragraph (e) of this clause are recognized and protected.

(2) Whenever any technical data for noncommercial items is to be obtained from a subcontractor or supplier for delivery to the Government under this contract, the Contractor shall use this same clause in the subcontract or other contractual instrument, and require its subcontractors or suppliers to do so, without alteration, except to identify the parties. No other clause shall be used to enlarge or diminish the Government's, the Contractor's, or a higher-tier subcontractor's or supplier's rights in a subcontractor's or supplier's technical data.

(3) Technical data required to be delivered by a subcontractor or supplier shall normally be delivered to the next higher-tier contractor, subcontractor, or supplier. However, when there is a requirement in the prime contract for data which may be submitted with other than unlimited rights by a subcontractor or supplier, then said subcontractor or supplier may fulfill its requirement by submitting such data directly to the Government, rather than through a higher-tier contractor, subcontractor, or supplier.

(4) The Contractor and higher-tier subcontractors or suppliers shall not use their power to award contracts as economic leverage to obtain rights in technical data from their subcontractors or suppliers.

(5) In no event shall the Contractor use its obligation to recognize and protect subcontractor or supplier rights in technical data as an excuse for failing to satisfy its contractual obligation to the Government.

2 January 1996

63. LIMITATIONS ON THE USE OR DISCLOSURE OF GOVERNMENT-FURNISHED INFORMATION MARKED WITH RESTRICTIVE LEGEND DFARS 252.227-7025 (JUN 1995)

(a)(1) For contracts requiring the delivery of technical data, the terms, "limited rights" and "Government purpose rights" are defined in the Rights in Technical Data--Noncommercial Items clause of this contract.

(2) For contracts that do not require the delivery of technical data, the terms "government purpose rights" and "restricted rights" are defined in the Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation clause of this contract.

(3) For Small Business Innovative Research program contracts, the terms "limited rights" and "restricted rights" are defined in the Rights in Noncommercial Technical Data and Computer Software--Small Business Innovative Research (SBIR) Program clause of this contract.

(b) Technical data or computer software provided to the Contractor as Government furnished information (GFI) under this contract may be subject to restrictions on use, modification, reproduction, release, performance, display, or further disclosure.

(1) GFI marked with limited or restricted rights legends.

The Contractor shall use, modify, reproduce, perform, or display technical data received from the Government with limited rights legends or computer software received with restricted rights legends only in the performance of this contract. The Contractor shall not, without the express written permission of the party whose name appears in the legend, release or disclose such data or software to any person.

(2) GFI marked with government purpose rights legends.

The Contractor shall use technical data or computer software received from the Government with government purpose rights legends for government purposes only. The Contractor shall not, without the express written permission of the party whose name appears in the restrictive legend, use, modify, reproduce, release, perform, or display such data or software for any commercial purpose or disclose such data or software to a person other than its subcontractors, suppliers, or prospective subcontractors or suppliers, who require the data or software to submit offers for, or perform, contracts under this contract. Prior to disclosing the data or software, the Contractor shall require the persons to whom disclosure will be made to complete and sign the non-disclosure agreement at 227.7103-7 of the Defense Federal Acquisition Regulation Supplement (DFARS).

(3) GFI marked with specially negotiated license rights legends.

The Contractor shall use, modify, reproduce, release, perform, or display technical data or computer software received from the Government with specially negotiated license legends only as permitted in the license. Such data or software may not be release or disclosed to other persons unless permitted by the license and, prior to release or disclosure, the intended recipient has completed the non-disclosure agreement at DFARS 227.7103-7. The Contractor shall modify paragraph (1)(c) of the non-disclosure agreement to reflect the recipient's obligations regarding use, modification, reproduction, release, performance, display, and disclosure of the data of software.

(c) Indemnification and creation of third party beneficiary rights.

The Contractor agrees--

(1) To indemnify and hold harmless the Government, its agents, and employees from every claim or liability, including attorneys fees, court costs, and expenses, arising out of, or in any way related to, the misuse or unauthorized modification, reproduction, release, performance, display, or disclosure of technical data or computer software received from the Government with restrictive legends by the Contractor or any person to whom the Contractor has released or disclosed such data or software; and

(2) That the party whose name appears on the restrictive legend, in addition to any other rights it may have, is a third party beneficiary who has the right of direct action against the Contractor, or any person to whom the Contractor has released or disclosed such data or software, for the unauthorized duplication, release, or disclosure of technical data or computer software subject to restrictive legends.

20 March 1997

64. thru 67. NOT USED.

1 NOV 1991

68. FIRMER APPLICABILITY (Oct 89 FIRMER) This solicitation/contract requires the use or delivery of Federal information processing resources but the agency has determined that FIRMER part 201-39 does not apply based on the exception set forth in 201-39.101-3(b)(5)(ii).

2 January 1996

69. BASIS FOR SETTLEMENT OF PROPOSALS. EFARS 52.249-5000. Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In evaluating a terminations settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for allowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate.

70. NOT USED.

8 October 1996

71. PARTNERING. In order to most effectively and efficiently accomplish the work provided for in this contract, the Government is encouraging the formation of a cohesive, mutually beneficial partnership with the Contractor and its subcontractors. This partnership would strive to draw on the strengths, skills, and knowledge of each organization in an effort to achieve a quality project, done right the first time, within budget, safely, and on schedule. Partnering still requires full compliance with the contract, but the focus of partnering is to build cooperative relationships, avoid or minimize disputes and actively pursue the attainment of common goals by the contracting parties. Success will be dependent upon teamwork characterized by open and effective communication while always adhering to the highest of professional standards. The partnership would be bilateral in makeup and participation will be totally voluntary. Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

72. thru 82. NOT USED.

22 June 1998

83. YEAR 2000 COMPLIANCE

a. In accordance with FAR 39.106, the Contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically:

b. The Contractor shall:

(1) Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order which may be affected by the Y2K compliance requirements.

(2) Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to government acceptance.

GENERAL DECISION KY980007 07/06/98 KY7
General Decision Number KY980007

Superseded General Decision No. KY970007

State: Kentucky

Construction Type:
BUILDING

County(ies):

HARDIN JEFFERSON MEADE

BUILDING CONSTRUCTION PROJECTS (Does not include single
family homes and apartments up to and including 4 stories)

| Modification Number | Publication Date |
|---------------------|------------------|
| 0 | 02/13/1998 |
| 1 | 04/03/1998 |
| 2 | 05/22/1998 |
| 3 | 06/05/1998 |
| 4 | 06/19/1998 |
| 5 | 07/06/1998 |

COUNTY(ies):

HARDIN JEFFERSON MEADE

ASBE0051A 10/01/1997

| | Rates | Fringes |
|--|-------|---------|
| ASBESTOS WORKERS/INSULATORS (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems) | 19.93 | 5.77 |

| | | |
|---|-------|------|
| HAZARDOUS MATERIAL HANDLERS (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems) | 10.50 | 3.30 |
|---|-------|------|

BOIL0040A 10/01/1997

| | Rates | Fringes |
|--------------|-------|---------|
| BOILERMAKERS | 21.75 | 10.76 |

BRKY0001A 06/01/1998

| | Rates | Fringes |
|---|-------|---------|
| BRICKLAYERS; CAULKERS; CLEANERS; POINTERS & STONE MASONS | 18.28 | 4.28 |
| LAYOUT MAN; & SAW MAN | 18.53 | 4.28 |
| REFRACTORY | 18.78 | 4.28 |

| | | |
|---|--------|-----------|
| BRKY0001C 01/01/1998 | | |
| | Rates | Fringes |
| MARBLE SETTERS; TERRAZZO WORKERS; & TILE SETTERS | 17.75 | 3.00 |
| MARBLE, TERRAZZO & TILE FINISHERS | 12.15 | 2.40 |
| ----- | | |
| CARP0064B 06/01/1998 | | |
| | Rates | Fringes |
| CARPENTERS | 17.45 | 4.67 |
| PILEDRIVERMEN | 17.70 | 4.67 |
| ----- | | |
| CARP1031G 06/01/1998 | | |
| | Rates | Fringes |
| MILLWRIGHTS | 20.20 | 7.95 |
| ----- | | |
| ELEC0369A 06/01/1998 | | |
| | Rates | Fringes |
| ELECTRICIANS | 22.25 | 6.34 |
| ----- | | |
| ELEC0369C 06/01/1995 | | |
| | Rates | Fringes |
| LINE CONSTRUCTION: | | |
| Linemen; Equipment Operators; & Line Truck Operators | 20.94 | 5.28 |
| Backhoes | 16.76 | 4.70 |
| Trenchers | 15.72 | 4.66 |
| Truck Drivers | 14.67 | 4.41 |
| Groundmen | 13.00 | 4.19 |
| ----- | | |
| ELEV0020A 10/01/1997 | | |
| | Rates | Fringes |
| JEFFERSON COUNTY: | | |
| ELEVATOR MECHANICS | 22.205 | 6.405+a+b |
| FOOTNOTES: | | |
| a. Seven Paid Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Day after Thanksgiving; & Christmas Day | | |
| b. Employer contributes 8% of regular hourly rate to vacation pay credit for employee who has worked in business more than 5 years; 6% for less than 5 years. | | |
| ----- | | |
| ENGI1810A 06/01/1998 | | |
| | Rates | Fringes |
| POWER EQUIPMENT OPERATORS: | | |
| GROUP 1 | 18.90 | 5.90 |
| GROUP 2 | 16.16 | 5.90 |

GROUP 3

15.39

5.90

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - Auto Patrol; Batcher Plant; Bituminous Paver; Cableway; Central Compressor Plant; Clamshell; Concrete Mixer 1 cu. ft. or over); Concrete Pump; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Dredge Operator; Dredge Engineer; Elevating Grader & Loader; Hoe Type Machine; Hoist (1 Drum when used for stack or chimney construction or repair); Hoisting Engine (2 or more Drums); Locomotive; Motor Scraper; Carry-All Scoop; Bulldozer; Mechanic; Orangepeel Bucket; Piledriver; Power Blade; Motor Grader; Roller (Bituminous); Scarifier; Shovel; Tractor Shovel; Truck Crane; Winch Truck; Push Dozer; Highlift; Boom Cat; Core Drill; Hopto; Tow or Push Boat; A-Frame Winch Truck; Concrete Paver; Gradeall; Hoist; Hyster; Pumpcrete; Ross Carrier; Boom; Tail Boom; Rotary Drill; Hydro Hammer; Mucking

Machine; Rock Spreader (Attached to Equipment); Scoopmobile; Kecal Loader; Tower Crane (French, German & Other Types); Hydrocrane; Backfiller; Gurry; Subgrader; Tunnel Mining Machine, including Moles; Shield or similar types of Tunnel Mining Equipment; & Forklift (Regardless of Lift Height)

GROUP 2 - Air Compressor (Over 900 CFM); Bituminous Mixer; Joint Sealing Machine; Concrete Mixer (Under 21 cu. ft.); Form Grader; Roller (Rock); Tractor (50 H.P. & Over); Bull Float; Finish Machine; Outboard Motor Boat; Flexplane; Fireperson; Boom Type Tamping Machine; Greaser on Grease Facilities Servicing Heavy Equipment; Switchman or Brakeman; Whirley Oiler; Self-Propelled Compactor; Tractair & Road Widening Trencher & Farm Tractor with attachments (Except Backhoe, Highlift & End Loader); Elevator; Hoisting Engineer (1 Drum or Buck Hoist, Firebrick Masonry Excluded); Well Point; Grout Pump; Throttle Valve Person; Tugger; & Electric Vibrator Compactor

GROUP 3 - Bituminous Distributor; Cement Gun; Conveyor; Mud Jack; Paving Joint Machine; Roller (Earth); Tamping Machine; Tractor (Under 50 H.P.); Vibrator; Oiler; Concrete Saw; Burlap & Curing Machine; Truck Crane Oiler; Hydro Seeder; Power Form Handling Equipment; Deckhand Steersman; & Hydraulic Post Driver

CRANE WITH BOOM 150 FEET & OVER, INCLUDING JIB SHALL RECEIVE \$.50 ABOVE GROUP 1

* IRON0070A 06/01/1998

| | Rates | Fringes |
|--------------------------------------|-------|---------|
| IRONWORKERS: | | |
| Structural; Ornamental; Reinforcing; | | |
| & Precast Concrete Erectors | 20.26 | 9.32 |

* LABO0576A 07/01/1998

| | Rates | Fringes |
|---|-------|---------|
| LABORERS: | | |
| GROUP 1 | 12.62 | 3.78 |
| GROUP 2 | 12.82 | 3.78 |
| GROUP 3 | 12.92 | 3.78 |
| GROUP 4 | 13.62 | 3.78 |
| GROUP 5 | 14.12 | 3.78 |
| GROUP 1 - General; Carpenter Tender; Cement Finisher Tender; Placing of Concrete; Wrecking of Buildings; Hand Digging & Hand Backfilling of Ditches; Clearing of Rights-of-Way & Building Sites; Curing of Concrete; Application Hardener; Handling of Chemically Treated Lumber; Installing of Wood Sheeting & Shoring; Signal Laborer; Concrete Bucket & Masonry Work; Cleaning & Moving of General Purpose Materials; General Cleanup of Scrap & Debris; & Mobile Sweeper | | |
| GROUP 2 - Mason Tender; Side Rail Setter (Metal); Stackman; Fork Lift Operator (Masonry & Plastering Contractors only); Power Driven Georgia Buggy; Chain Saw; Vibrator Operator; Mesh Handler; Power Tools (Air, Diesel, Electric, Gasoline); Wagon Drill; Pipe Layer; Wall Man; Treatment of Exposed Concrete (Chip, Bush Hammer & Rub); Concrete Saw; Gasoline Tampor Machine; Walk Behind Trenching Machine; Burner Man; Joint Maker; & Asphalt Raker | | |
| GROUP 3 - Air Track Driller; Introflax Burning Rod; Gunnite Nozzle Man Operator; Sewer, Tunnel Laborer (Free Air); & Sand Hog or Mucker (Free Air) | | |
| GROUP 4 - Holeman Drilled Piers; Augered Caissons; Sand Miner (Tunnel Free Air); Caisson Worker; & Powderman | | |
| GROUP 5 - Tunnel Person & Tunnel Miner (Pressure & Free Air); Environmental Worker; Toxic & Hazardous Waste; & Asbestos Removal | | |

PAIN0118A 05/01/1998

| | Rates | Fringes |
|---|-------|---------|
| PAINTERS: | | |
| Brush; Drywall Finisher-Vinyl Hanger | 15.57 | 4.00 |
| Abrasive Blaster; Fireproofing; Lead Abatement; Spray; & Waterblasting 4000 PSI and Above | 16.07 | 4.00 |

PAIN1165E 04/01/1998

| | Rates | Fringes |
|----------|-------|---------|
| GLAZIERS | 19.61 | 4.39 |

PLAS0692A 06/01/1996

| | Rates | Fringes |
|---------------|-------|---------|
| CEMENT MASONS | 14.25 | 4.90 |

| | | |
|------------------------------|-------|---------|
| PLUM0107A 08/01/1997 | | |
| | Rates | Fringes |
| PLUMBERS; GAS FITTERS: | | |
| Plumbing contracts less than | | |
| \$150,000.00 | 16.59 | 5.02 |
| All Other Plumbing contracts | 21.51 | 5.02 |

| | | |
|----------------------------|-------|---------|
| PLUM0522A 08/01/1997 | | |
| | Rates | Fringes |
| PIPEFITTERS & STEAMFITTERS | 22.80 | 6.20 |

| | | |
|------------------------|-------|---------|
| * ROOF0147A 07/01/1998 | | |
| | Rates | Fringes |
| ROOFERS | 15.65 | 4.60 |

| | | |
|----------------------|-------|---------|
| SFKY0669A 04/01/1998 | | |
| | Rates | Fringes |
| SPRINKLER FITTERS | 20.94 | 6.35 |

| | | |
|------------------------------|-------|---------|
| SHEE0110C 01/01/1998 | | |
| | Rates | Fringes |
| HARDIN & JEFFERSON COUNTIES: | | |

SHEET METAL WORKERS:

Light Commercial Work (Single buildings not inside or adjoining an industrial complex & that type work falling into the following categories: bowling alleys, chapels, churches, funeral homes, service stations, night clubs, pool rooms, nursing homes, restaurants, skating rinks, storage facilities (80,000 square feet or less), community/ all purpose buildings, recreational buildings (gyms, spas), branch banks, barber and beauty shops, stores (80,000 square feet or less), garages (body, tire, muffler & service shops), dance halls, nurseries, kindergarten & preschool centers, open faced shopping centers (ten stores or less), office facilities (less than 80,000 square feet and less than six floors above grade) & pre-engineered buildings (80,000 square feet or less)

| | | |
|----------------|-------|------|
| | 10.29 | 5.47 |
| All Other Work | 21.15 | 7.82 |

| | | |
|----------------------|-------|---------|
| SHEE0110D 01/01/1998 | | |
| | Rates | Fringes |
| MEADE COUNTY: | | |

SHEET METAL WORKERS:

Light Commercial Work (Single buildings not inside or adjoining an industrial complex & that type work falling into the following categories: bowling alleys, chapels, churches, funeral homes, service stations, night clubs,

pool rooms, nursing homes, restaurants, skating rinks,
storage facilities (80,000 square feet or less), community/
all purpose buildings, recreational buildings (gyms, spas),
branch banks, barber and beauty shops, stores (80,000 square
feet or less), garages (body, tire, muffler & service shops),
dance halls, nurseries, kindergarten & preschool centers,
open faced shopping centers (ten stores or less), office
facilities (less than 80,000 square feet and less than six
floors above grade) & pre-engineered buildings (80,000
square feet or less) 10.29 5.47
All Other Work 22.90 7.82

* TEAM0089A 06/01/1998

| | Rates | Fringes |
|----------------|-------|---------|
| TRUCK DRIVERS: | | |
| GROUP 1 | 16.07 | a&b |
| GROUP 2 | 16.18 | a&b |
| GROUP 3 | 16.25 | a&b |
| GROUP 4 | 16.35 | a&b |

WORK ON HAZARDOUS OR TOXIC WASTE SITES - \$4.00 PREMIUM

FOOTNOTES:

a. Employer contribution of \$259.70 per employee per week
whose name appears on the payroll and has been employed a
minimum of 20 work days within any 90 consecutive day
period.

b. Paid vacation of 40 hours to any employee who has been
regularly employed on a project for 1 year and who has
worked a minimum of 1,200 hours during the year, and 2
weeks' paid vacation to any employee who has completed 3
years' employment on a project and who has worked 1,200
hours since their 2nd anniversary date.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - 3 Tons & Under; Greaser; Tire Changer; & Mechanic
Tender

GROUP 2 - Over 3 Tons; Semi-Trailer or Pole Trailer; Dump
Tandem Axles; Farm Tractor (When used to pull building material
& equipment)

GROUP 3 - Concrete Mixer (Hauling on jobsites); & Truck
Mechanic

GROUP 4 - Euclids & Other Heavy Moving Equipment; Lowboy;
Winch, A-Frame & Monorail Truck (To transport building
materials)

WELDERS - Receive rate prescribed for craft performing operation
to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.
END OF GENERAL DECISION

GENERAL DECISION KY980027 07/06/98 KY27
General Decision Number KY980027

Superseded General Decision No. KY970027

State: Kentucky

Construction Type:
HEAVY
HIGHWAY

County(ies):

| | | |
|--------------|-----------|------------|
| ANDERSON | GALLATIN | MERCER |
| BATH | GRANT | MONTGOMERY |
| BOURBON | GRAYSON | NELSON |
| BOYD | GREENUP | NICHOLAS |
| BOYLE | HARDIN | OLDHAM |
| BRACKEN | HARRISON | OWEN |
| BRECKINRIDGE | HENRY | ROBERTSON |
| BULLITT | JEFFERSON | ROWAN |
| CARROLL | JESSAMINE | SCOTT |
| CARTER | LARUE | SHELBY |
| CLARK | LEWIS | SPENCER |
| ELLIOTT | MADISON | TRIMBLE |
| FAYETTE | MARION | WASHINGTON |
| FLEMING | MASON | WOODFORD |
| FRANKLIN | MEADE | |

Heavy and Highway Construction Projects

| Modification Number | Publication Date |
|---------------------|------------------|
| 0 | 02/13/1998 |
| 1 | 02/20/1998 |
| 2 | 03/13/1998 |
| 3 | 04/03/1998 |
| 4 | 05/22/1998 |
| 5 | 06/05/1998 |
| 6 | 06/19/1998 |
| 7 | 07/06/1998 |

COUNTY(ies):

| | | |
|--------------|-----------|------------|
| ANDERSON | GALLATIN | MERCER |
| BATH | GRANT | MONTGOMERY |
| BOURBON | GRAYSON | NELSON |
| BOYD | GREENUP | NICHOLAS |
| BOYLE | HARDIN | OLDHAM |
| BRACKEN | HARRISON | OWEN |
| BRECKINRIDGE | HENRY | ROBERTSON |
| BULLITT | JEFFERSON | ROWAN |
| CARROLL | JESSAMINE | SCOTT |
| CARTER | LARUE | SHELBY |
| CLARK | LEWIS | SPENCER |
| ELLIOTT | MADISON | TRIMBLE |
| FAYETTE | MARION | WASHINGTON |
| FLEMING | MASON | WOODFORD |
| FRANKLIN | MEADE | |

| | | | |
|--|------------|-------|---------|
| BRIN0004D | 04/01/1998 | | |
| | | Rates | Fringes |
| BRECKINRIDGE COUNTY: | | | |
| BRICKLAYERS | | 21.61 | 5.15 |
| ----- | | | |
| BRKY0001G | 06/01/1998 | | |
| | | Rates | Fringes |
| BULLITT, CARROLL, GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER & TRIMBLE COUNTIES: | | | |
| BRICKLAYERS | | 18.28 | 4.28 |
| ----- | | | |
| BRKY0002F | 06/01/1997 | | |
| | | Rates | Fringes |
| BRACKEN, GALLATIN, GRANT, MASON & ROBERTSON COUNTIES: | | | |
| BRICKLAYERS | | 20.01 | 4.79 |
| ----- | | | |
| BRKY0007D | 06/01/1997 | | |
| | | Rates | Fringes |
| BOYD, CARTER, ELLIOTT, FLEMING, GREENUP, LEWIS & ROWAN COUNTIES: | | | |
| BRICKLAYERS | | 21.18 | 6.20 |
| ----- | | | |
| BRKY0017D | 06/01/1996 | | |
| | | Rates | Fringes |
| ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FRANKLIN, HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, OWEN, SCOTT, WASHINGTON & WOODFORD COUNTIES: | | | |
| BRICKLAYERS | | 15.50 | 2.55 |
| LAYOUT MEN | | 15.75 | 2.55 |
| ----- | | | |
| * CARP0064A | 07/01/1998 | | |
| | | Rates | Fringes |
| CARPENTERS | | 18.45 | 4.43 |
| PILED RIVERMEN | | 18.70 | 4.43 |
| DIVERS | | 28.05 | 4.43 |
| ----- | | | |
| CARP1031P | 06/01/1998 | | |
| | | Rates | Fringes |
| ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FRANKLIN, HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, OWEN, SCOTT & WOODFORD COUNTIES: | | | |
| MILLRIGHTS | | 18.04 | 6.69 |
| ----- | | | |

| | | | |
|--|------------|-------|---------|
| CARP1031Q | 06/01/1998 | | |
| | | Rates | Fringes |
| BOYD, CARTER, ELLIOTT, FLEMING, GREENUP, LEWIS, MASON, ROBERTSON & ROWAN COUNTIES: | | | |
| MILLWRIGHTS | | 19.40 | 11.24 |
| ----- | | | |
| CARP1031R | 06/01/1998 | | |
| | | Rates | Fringes |
| BRECKINRIDGE, BULLITT, CARROLL, GALLATIN, GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES: | | | |
| MILLWRIGHTS | | 20.20 | 7.95 |
| ----- | | | |
| CARP1066D | 09/01/1997 | | |
| | | Rates | Fringes |
| BRACKEN & GRANT COUNTIES: | | | |
| MILLWRIGHTS | | 21.35 | 6.395 |
| ----- | | | |
| ELEC0183C | 06/01/1997 | | |
| | | Rates | Fringes |
| ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FRANKLIN, HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, OWEN, ROBERTSON, SCOTT & WOODFORD COUNTIES: | | | |
| ELECTRICIANS | | 19.70 | 6.24 |
| ----- | | | |
| ELEC0212Q | 06/01/1997 | | |
| | | Rates | Fringes |
| BRACKEN, GALLATIN & GRANT COUNTIES: | | | |
| ELECTRICIANS | | 20.30 | 6.61 |
| ----- | | | |
| ELEC0317L | 06/01/1997 | | |
| | | Rates | Fringes |
| BOYD, CARTER, ELLIOTT & ROWAN COUNTIES: | | | |
| ELECTRICIANS: | | | |
| Electricians | | 18.80 | 10.77 |
| Cable Splicers | | 19.74 | 10.80 |
| ----- | | | |
| ELEC0369J | 06/01/1998 | | |
| | | Rates | Fringes |
| BRECKINRIDGE, BULLITT, CARROLL, GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES: | | | |

| | | |
|--------------|-------|------|
| ELECTRICIANS | 22.25 | 6.34 |
|--------------|-------|------|

| | | |
|----------------------|-------|---------|
| ELEC0575B 06/01/1998 | Rates | Fringes |
|----------------------|-------|---------|

FLEMING, GREENUP, LEWIS & MASON COUNTIES:

| | | |
|--------------|-------|------|
| ELECTRICIANS | 23.80 | 6.63 |
|--------------|-------|------|

| | | |
|----------------------|-------|---------|
| ENGI0181Y 01/01/1998 | Rates | Fringes |
|----------------------|-------|---------|

POWER EQUIPMENT OPERATORS:

| | | |
|---------|-------|------|
| GROUP 1 | 19.55 | 5.90 |
| GROUP 2 | 17.13 | 5.90 |
| GROUP 3 | 17.51 | 5.90 |
| GROUP 4 | 16.87 | 5.90 |

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - A-Frame Winch Truck; Auto Patrol; Backfiller; Batcher Plant; Bituminous Paver; Boom Cat; Bulldozer; Mechanic; Cableway; Carry-All Scoop; Central Compressor Plant Operator; Clamshell; Concrete Mixer (21 cu. ft. or over); Concrete Paver; Truck-Mounted Concrete Pump; Core Drill; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Elevating Grader & Loader; Gradeall; Gurry; High Lift; Hoe-Type Machine; Hoist (2 or more drums); Hoisting Engine (2 or more drums); Hydrocrane; Hyster; KeCal Loader; LeTourneau; Locomotive; Mechanic Welder; Mucking Machine; Motor Scraper; Orangepeel Bucket; Piledriver; Power Blade; Pumpcrete; Push Dozer; Rock Spreader, attached to equipment; Rotary Drill; Roller (Bituminous); Scarifier; Scoopmobile; Shovel; Side Boom; Subgrader; Tailboom; Tow or

Push Boat; Tower Crane (French, German & other types); Tractor Shovel; & Truck Crane

GROUP 2 - Air Compressor (over 900 cu. ft. per min.); Bituminous Mixer; Boom Type Tamping Machine; Bull Float; Concrete Mixer (Under 21 cu. ft.); Dredge Engineer; Electric Vibrator Compactor; Self-propelled Compactor; Elevator (One Drum or Buck Hoist); Elevator (When used to hoist building materials); Finish Machine; Fireperson; Hoist (1 drum); Flexplane; Forklift; Form Grader; Joint Sealing Machine; Outboard Motor Boat; Power Sweeper (Riding Type); Roller (Rock); Ross Carrier; Skid Mounted or Trailer Mounted Concrete Pump; Switchman or Brakeman; Throttle Valve Man; Tractair & Road Widening Trencher; Tractor (50 H.P. or Over); Truck Crane Oiler; Tugger; Welding Machine; Well Points; & Whirley Oiler

GROUP 3 - Greaser on Grease Facilities Servicing Heavy Equipment

GROUP 4 - Bituminous Distributor; Burlap & Curing Machine;

Cement Gun; Concrete Saw; Conveyor; Deckhand Oiler; Grout Pump; Hydraulic Post Driver; Hydro Seeder; Mud Jack; Oiler; Paving Joint Machine; Power Form Handling Equipment; Pump; Roller (Earth); Steerman; Tamping Machine; Tractor (Under 50 H.P.); & Vibrator

CRANES WITH BOOMS 150 FEET & OVER (INCLUDING JIB) SHALL RECEIVE \$.50 ABOVE BASE RATE.

EMPLOYEES ASSIGNED TO WORK BELOW GROUND LEVEL ARE TO BE PAID 10% ABOVE BASIC WAGE RATE. THIS DOES NOT APPLY TO OPEN CUT WORK.

IRON0044I 06/01/1998

| | Rates | Fringes |
|---|-------|---------|
| BOURBON (Northern third, including Townships of Jackson, Millersburg, Ruddel Mills & Shawhan); | | |
| CARROLL (Eastern third, including the Township of Ghent); | | |
| FLEMING (Western part, excluding Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksridge, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford); | | |
| MASON (Western two-thirds, including Townships of Dover, Lewisburg, Mays Lick, Maysville, Minerva, Moranburg, Murphysville, Ripley, Sardis, Shannon, South Ripley & Washington); | | |
| NICHOLAS (Townships of Barefoot, Barterville, Carlisle, Ellisville, Headquarters, Henryville, Morningglory, Myers & Oakland Mills); | | |
| OWEN (Townships of Beechwood, Bromley, Fairbanks, Holbrook, Jonesville, Long Ridge, Lusby's Mill, New, New Columbus, New Liberty, Owenton, Poplar Grove, Rockdale, Sanders, Teresita & Wheatley); | | |
| SCOTT (Northern two-thirds, including Townships of Biddle, Davis, Delaplain, Elmville, Longlick, Muddy Ford, Oxford, Rogers Gap, Sadieville, Skinnersburg & Stonewall) & | | |
| BRACKEN, GALLATIN, GRANT, HARRISON & ROBERTSON COUNTIES: | | |

IRONWORKERS:

| | | |
|---------------|-------|------|
| Structural | 20.20 | 8.94 |
| Fence Erector | 18.18 | 8.94 |

* IRON0070J 06/01/1998

| | Rates | Fringes |
|--|-------|---------|
| BOURBON (Southern two-thirds, including Townships of Austerlity, Centerville, Clintonville, Elizabeth, Hutchison, Littlerock, North Middletown & Paris); | | |

CARROLL (Western two-thirds, including Townships of Carrollton, Easterday, English, Locust, Louis, Prestonville & Worthville);

CLARK (Western two-thirds, including Townships of Becknerville, Flanagan, Ford, Pine Grove, Winchester & Wyandotte);

OWEN (Eastern eighth, including Townships of Glenmary, Gratz, Monterey, Perry Park & Tacketts Mill);

SCOTT (Southern third, including Townships of Georgetown, Great Crossing, Newtown, Stampling Ground & Woodlake);

ANDERSON, BOYLE, BRECKINRIDGE, BULLITT, FAYETTE, FRANKLIN, GRAYSON, HARDIN, HENRY, JEFFERSON, JESSAMINE, LARUE, MADISON, MARION, MEADE, MERCER, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE, WASHINGTON & WOODFORD COUNTIES:

| | | |
|-------------|-------|------|
| IRONWORKERS | 20.26 | 9.32 |
|-------------|-------|------|

IRON0372F 12/01/1997

Rates

Fringes

BOURBON (Northern third, including Townships of Jackson, Millersburg, Ruddel Mills & Shawhan);

CARROLL (Eastern third, including the Township of Ghent);

FLEMING (Western part, Excluding Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksville, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford);

MASON (Western two-thirds, including Townships of Dover,

Lewisburg, Mays Lick, Maysville, Minerva, Moranburg, Murphysville, Ripley, Sardis, Shannon, South Ripley & Washington);

NICHOLAS (Townships of Barefoot, Barterville, Carlisle, Ellisville, Headquarters, Henryville, Morningglory, Myers & Oakland Mills);

OWEN (Townships of Beechwood, Bromley, Fairbanks, Holbrook, Jonesville, Long Ridge, Lusby's Mill, New, New Columbus, New Liberty, Owenton, Poplar Grove, Rockdale, Sanders, Teresita & Wheatley);

SCOTT (Northern two-thirds, including Townships of Biddle, Davis, Delaplain, Elmville, Longlick, Muddy Ford, Oxford, Rogers Gap, Sadieville, Skinnersburg & Stonewall);

BRACKEN, GALLATIN, GRANT, HARRISON & ROBERTSON COUNTIES:

IRONWORKERS, Reinforcing:

Up to & including 25-mile radius
of Hamilton County, Ohio

| | | |
|---|-------|------|
| Courthouse | 19.72 | 7.89 |
| Beyond 25-mile radius of Hamilton County, Ohio Courthouse | 19.97 | 7.89 |

IRON0769G 06/01/1997

| | Rates | Fringes |
|--|-------|---------|
|--|-------|---------|

CLARK (Eastern third, including Townships of Bloomingdale, Hunt, Indian Fields, Kiddville, Loglick, Rightangele & Thomson);

FLEMING (Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksridge, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford);

MASON (Eastern third, including Townships of Helena, Marshall, Orangeburg, Plumville & Springdale);

NICHOLAS (Eastern eighth, including the Township of Moorefield Sprout);

BATH, BOYD, CARTER, ELLIOTT, GREENUP, LEWIS, MONTGOMERY & ROWAN COUNTIES:

IRONWORKERS:

ZONE 1:

| | | |
|----------------|-------|------|
| Sheeter | 21.40 | 9.31 |
| All Other Work | 21.15 | 9.31 |

ZONE 2:

| | | |
|----------------|-------|------|
| Sheeter | 21.80 | 9.31 |
| All Other Work | 21.55 | 9.31 |

ZONE 3:

| | | |
|----------------|-------|------|
| Sheeter | 23.80 | 9.31 |
| All Other Work | 23.55 | 9.31 |

ZONE 1 - Up to 10 mi. radius of union hall, Ashland, Ky., 1643 Greenup Avenue

ZONE 2 - 10 to 50 mi. radius of union hall;

ZONE 3 - 50 mi. radius and beyond

* LABO0189C 07/01/1998

| | Rates | Fringes |
|--|-------|---------|
|--|-------|---------|

LABORERS:

| | | |
|---------|-------|------|
| GROUP 1 | 14.97 | 4.53 |
| GROUP 2 | 15.22 | 4.53 |
| GROUP 3 | 15.27 | 4.53 |
| GROUP 4 | 15.87 | 4.53 |

LABORERS CLASSIFICATIONS

GROUP 1 - Aging & Curing of Concrete; Asbestos Abatement Worker; Asphalt Plant; Asphalt; Batch Truck Dump; Carpenter Tender;

Cement Mason Tender; Cleaning of Machines; Concrete; Demolition; Dredging; Drill Tender; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Level D; Flagperson; Grade Checker; Hand Digging & Hand Back Filling; Highway Marker Placer; Landscaping, Mesh Handler & Placer; Puddler; Railroad; Rip-rap & Grouter; Right-of-Way; Sign, Guard Rail & Fence Installer; Signal Person; Sound Barrier Installer; Storm & Sanitary Sewer; Swamper; Truck Spotter & Dumper; & Wrecking of Concrete Form

GROUP 2 - Batter Board Man (Sanitary & Storm Sewer); Brickmason Tender; Mortar Mixer Operator; Burner & Welder; Bushhammer; Chain Saw Operator; Concrete Saw Operator; Deckhand Scow Man; Dry Cement Handler; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Level C; Forklift Operator for Masonary; Form Setter; Green Concrete Cutting; Hand Operated Grouter & Grinder Machine Operator; Jackhammer; Pavement Breaker; Paving Joint Machine; Pipelayer; Plastic Pipe Fusion; Power Driven Georgia Buggy & Wheel Barrow; Power Post Hole Digger; Precast Manhole Setter; Walk-Behind Tamper; Walk-Behind Trencher; Sand Blaster; Concrete Chipper; Surface Grinder; Vibrator Operator; & Wagon Driller

GROUP 3 - Air Track Driller; Asphalt Luteman & Raker; Gunnite Nozzleman; Gunnite Operator & Mixer; Grout Pump Operator; Powderman & Blaster; Side Rail Setter; Rail Paved Ditch; Screw Operator; Tunnel (Free Air); & Water Blaster

GROUP 4 - Caisson Worker (Free Air); Cement Finisher; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Levels A & B; Miner & Driller (Free Air); Tunnel Blaster; & Tunnel Mucker (Free Air)

PAIN0012M 06/15/1996

| | Rates | Fringes |
|--|-------|---------|
| BRACKEN, GALLATIN, GRANT, MASON & OWEN COUNTIES: | | |

PAINTERS:

| | | |
|---------|-------|------|
| GROUP 1 | 18.25 | 3.85 |
| GROUP 2 | 18.75 | 3.85 |
| GROUP 3 | 19.00 | 3.85 |
| GROUP 4 | 19.25 | 3.85 |
| GROUP 5 | 20.00 | 3.85 |

PAINTER CLASSIFICATIONS

GROUP 1 - Brush; Roller; & Tanks

GROUP 2 - Spray

GROUP 3 - Sandblasting; Hopper Tender; & Water Blasting

GROUP 4 - Bridges when highest point of clearance is 60 feet or more; Lead Paint Abatement; Elevated Tanks 40 feet or over; Radio Towers, Stacks, Light Towers, Water Towers, Steeples, Skeleton Steel; Sandblasting, Hopper Tender & Waterblasting

under Hazardous Conditions; & Work over 60 feet in height

GROUP 5 - Sandblasting, Hopper Tender, Waterblasting on Bridges
when highest point of clearance is 60 feet or more

PAIN0118D 05/01/1998

| | Rates | Fringes |
|--|-------|---------|
| ANDERSON, BRECKINRIDGE, BULLITT, CARROLL, GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES: | | |

PAINTERS:

| | | |
|---|-------|------|
| Brush | 15.57 | 4.00 |
| Abrasive Blaster; Fireproofing; Lead Abatement; Spray; & Waterblasting 4000 PSI and Above | 16.07 | 4.00 |

PAIN1072D 06/01/1995

| | Rates | Fringes |
|--|-------|---------|
| BOYD, CARTER, ELLIOTT, FLEMING, GREENUP, LEWIS & ROWAN COUNTIES: | | |

PAINTERS:

| | | |
|----------------|-------|------|
| Bridges | 21.88 | 5.03 |
| All Other Work | 19.16 | 5.03 |

PAIN1072F 09/30/1997

| | Rates | Fringes |
|---|-------|---------|
| BATH, BOURBON, BOYLE, CLARK, FAYETTE, FRANKLIN, HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, ROBERTSON, | | |

SCOTT & WOODFORD COUNTIES:

PAINTERS:

| | | |
|----------------|-------|------|
| Bridges | 21.88 | 5.03 |
| All Other Work | 14.70 | 3.06 |

PLUM0059I 06/01/1998

| | Rates | Fringes |
|--|-------|---------|
| BRACKEN, CARROLL (Eastern Half), GALLATIN, GRANT, MASON, OWEN & ROBERTSON COUNTIES: | | |

| | | |
|----------|-------|------|
| PLUMBERS | 22.78 | 7.74 |
|----------|-------|------|

PLUM0107F 08/01/1997

| | Rates | Fringes |
|--|-------|---------|
| BRECKINRIDGE, BULLITT, CARROLL (Western Half), FRANKLIN (Western three-fourths), GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES: | | |

PLUMBERS; GAS FITTERS:

Plumbing contracts less than

| | | |
|------------------------------|-------|------|
| \$150,000.00 | 16.59 | 5.02 |
| All Other Plumbing contracts | 21.51 | 5.02 |

PLUM0248C 06/01/1997

| | Rates | Fringes |
|---|-------|---------|
| BOYD, CARTER, ELLIOTT, GREENUP, LEWIS & ROWAN COUNTIES: | | |
| PLUMBERS & STEAMFITTERS | 20.76 | 9.22 |

* PLUM0392H 06/01/1998

| | Rates | Fringes |
|---|-------|---------|
| BRACKEN, CARROLL (Eastern Half), GALLATIN, GRANT, MASON, OWEN & ROBERTSON COUNTIES: | | |
| PIPEFITTERS & STEAMFITTERS | 23.50 | 6.22 |

PLUM0452C 11/01/1997

| | Rates | Fringes |
|--|-------|---------|
| ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FLEMING, FRANKLIN (Eastern one-fourth), HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, SCOTT & WOODFORD COUNTIES: | | |
| PIPEFITTERS & PLUMBERS: | | |
| Projects over 1 1/2 million dollars in piping contracts: | | |
| ZONE 1 | 21.15 | 4.52 |
| ZONE 2 | 22.15 | 4.52 |
| Projects under 1 1/2 million dollars in piping contracts: | | |
| ZONE 1 | 17.77 | 4.52 |
| ZONE 2 | 18.77 | 4.52 |
| ZONE 1 - Within 25 mile radius of Fayette County Courthouse | | |
| ZONE 2 - Beyond 25 mile radius of Fayette County Courthouse | | |

PLUM0522D 08/01/1997

| | Rates | Fringes |
|---|-------|---------|
| BRECKINRIDGE, BULLITT, CARROLL (Western Half), FRANKLIN (Western three-fourths), GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES: | | |
| PIPEFITTERS & STEAMFITTERS | 22.80 | 6.20 |

SUKY2003A 02/05/1996

| | Rates | Fringes |
|----------------|-------|---------|
| TRUCK DRIVERS: | | |
| GROUP 1 | 14.62 | 5.92 |
| GROUP 2 | 14.73 | 5.92 |
| GROUP 3 | 14.91 | 5.92 |
| GROUP 4 | 14.94 | 5.92 |
| GROUP 5 | 15.01 | 5.92 |

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Mobile Batch Truck Tender

GROUP 2 - Greaser; Tire Changer; & Mechanic Tender

GROUP 3 - Single Axle Dump; Flatbed; Semi-trailer or Pole Trailer when used to pull building materials and equipment; Tandem Axle Dump; Distributor; & Truck Mechanic

GROUP 4 - Mixer

GROUP 5 - Euclid & Other Heavy Earthmoving Equipment & Lowboy; Articulator Cat; 5-Axle Vehicle; Winch & A-Frame when used in transporting materials; Ross Carrier; Forklift when used to transport building materials; & Pavement Breaker

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations

indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch

of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.
END OF GENERAL DECISION

(ER 415 1-10)

SPECIFICATION SECTION

02050

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

02130

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

02221

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

02225

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

| | |
|----------------------|--|
| GOVERNMENT ACTION | |
|----------------------|--|

| |
|------------|
| CONTRACTOR |
|------------|

| | |
|--|--|
| | |
|--|--|

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

02233

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

02275

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

02316

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

02360

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

02450

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

02660

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

02720

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

02752

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

| | |
|----------------------|--|
| GOVERNMENT ACTION | |
|----------------------|--|

PAGE 1 OF 1 PAGES

(ER 415 1-10)

SPECIFICATION SECTION

02831

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

02935

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

02950

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

| | |
|----------------------|--|
| GOVERNMENT ACTION | |
|----------------------|--|

PAGE 1 OF 1 PAGES

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

03200

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

03250

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

SPECIFICATION SECTION

| | |
|----------------------|--|
| GOVERNMENT ACTION | |
|----------------------|--|

| |
|------------|
| CONTRACTOR |
|------------|

| | |
|--|--|
| | |
|--|--|

[illegible]

SUBMITTAL REGISTER

(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

04200

| ACTIVITY NO | TRANSMITTAL NO. | ITEM NO | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | TYPE OF SUBMITTAL | | | | | | | | | | CLASSIFICATION | REVIEWER | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | REMARKS | |
|----------------|--------------------|------------|--------------------------------------|------------------------------------|-------------------|------------------------------|----------------------|-----------------------|-------------------------|----------------------|----------------|---------------------|-----------------------|--------|----------------|----------|------------------------------|--------------------------|------|----------------------|-------------------------|------|----------------------|----|---------|-----|
| | | | | | DRAWINGS DATA | INSTRUMENTS INSTALLATIONS | SCHEDULES DETAILS | STATEMENTS REPORTS | CERTIFICATES RECORDS | SAFETY PROCEDURES | O&M MANUALS | INFORMATION ONLY | GOVERNMENT REMOVED | SUBMIT | | | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | | | |
| | | | | | | | | | | | | | | | s. | | | | | | | | | t. | | u. |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o. | p. | q. | r. | s. | t. | u. | v. | w. | x. | y. | z. | aa. |
| | | | 2.2 | Concrete Brick | X | | | | | | | | | | | X | | | | | | | | | | |
| | | | 2.11 | Insulation | X | | | | | | | | | | | X | | | | | | | | | | |
| | | | 1.2 | Masonry Work | | X | | | | | | | | | | X | | | | | | | | | | |
| | | | 3.1.2 | Cold Weather Installation | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 1.2 | Efflorescence Test | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 3.16.1 | Field Testing of Mortar | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 3.16.2 | Field Testing of Grout | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 1.2 | Prism tests | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 2.3.3 | Fire-rated CMU | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 1.4 | Special Inspection | | | | | X | | | | | | | X | | | | | | | | | | |
| | | | 2.2 | Concrete Brick | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.3 | Concrete Masonry Units (CMU) | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 1.2 | Control Joint Keys | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.7 | Anchors, Ties, and Bar Positioners | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.10 | Expansion-Joint Materials | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.8 | Joint Reinforcement | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.9 | Reinforcing Steel Bars and Rods | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.11 | Insulation | | | | | | X | | | | | | X | GA | | | | | | | | | |
| | | | 2.11 | Insulation | | | | | | X | | | | | | X | GA | | | | | | | | | |
| | | | 2.4 | Precast Concrete Items | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 1.2 | Mortar Admixtures | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 1.2 | Grout Admixtures | | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 2.3 | Concrete Masonry Units (CMU) | | | | | | | X | | | | | X | | | | | | | | | | |
| | | | 2.2 | Concrete Brick | | | | | | | X | | | | | X | | | | | | | | | | |
| | | | 2.7 | Anchors, Ties, and Bar Positioners | | | | | | | X | | | | | X | | | | | | | | | | |
| | | | 1.2 | Expansion-Joint Material | | | | | | | X | | | | | X | | | | | | | | | | |
| | | | 2.8 | Joint Reinforcement | | | | | | | X | | | | | X | | | | | | | | | | |
| | | | 2.11 | Insulation | | | | | | | X | | | | | X | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |

(ER 415 1-10)

SPECIFICATION SECTION

05055

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

05120

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

05300

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

05500

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

06100

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

| | |
|----------------------|--|
| GOVERNMENT ACTION | |
|----------------------|--|

| |
|------------|
| CONTRACTOR |
|------------|

| | |
|--|--|
| | |
|--|--|

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

07311

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

07416

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

07600

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

07900

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

| |
|-------------------|
| GOVERNMENT ACTION |
|-------------------|

| |
|------------|
| CONTRACTOR |
|------------|

| | | |
|--|--|--|
| | | |
|--|--|--|

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

08210

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

08510

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

08520

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

08700

| |
|------------|
| CONTRACTOR |
|------------|

| | |
|-------------------|--|
| GOVERNMENT ACTION | |
|-------------------|--|

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

08810

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

09250

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

09900

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

| | |
|--------------|--|
| CONTRACT NO. | |
|--------------|--|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

10800

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

12338

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

13121

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

| | |
|----------------------|--|
| GOVERNMENT ACTION | |
|----------------------|--|

PAGE 1 OF 1 PAGES

(ER 415 1-10)

| | |
|--------------|--|
| CONTRACT NO. | |
|--------------|--|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

15400

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

15488

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

15566

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

15653

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

15895

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

15950

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

15990

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

GOVERNMENT
ACTION

| |
|------------|
| CONTRACTOR |
|------------|

| | | |
|--|--|--|
| | | |
|--|--|--|

ENG FORM 4288, Jul 96

SPECSINTACT

PAGE 1 OF 1 PAGES

SUBMITTAL REGISTER

(ER 415 1-10)

CONTRACT NO.

TITLE AND LOCATION

CONTRACTOR

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

16375

| ACTIVITY NO. | TRANS-MITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | TYPE OF SUBMITTAL | | | | | | | | | | | | | CLASSI- FICATION | REVIEWER | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | REMARKS |
|-----------------|---------------------|-------------|--------------------------------------|--------------------------------------|-------------------|-------------|------------|--------------|--------|---------|-----|-------------|------------|--------|--------------------------|--------------------------|------|---------------------|----------|------------------------------|------------------------------|------|----------------------|----|----|----------------------|--|---------|
| | | | | | DRAWINGS | INSTRUMENTS | STATEMENTS | CERTIFICATES | SAFETY | PERMITS | O&M | INFORMATION | GOVERNMENT | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | | | DATE | SUBMIT TO GOVERN- MENT | CODE | DATE | | | | | |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o. | p. | q. | r. | s. | t. | u. | v. | w. | x. | y. | z. | aa. | | |
| | | | 1.3 | Fault Current and Protective Devices | X | | | | | | | | | | | X | | | | | | | | | | | | |
| | | | | Coordination Studies | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 1.3 | Manufacturer's Catalog Data | X | | | | | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Material, Equipment, and Fixture | X | | | | | | | | | | | X | | | | | | | | | | | | |
| | | | | Lists | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 1.3 | Installation Procedures | X | | | | | | | | | | X | | | | | | | | | | | | | |
| | | | 1.3 | Electrical Distribution System | | X | | | | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | As-Built Drawings | | X | | | | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Factory Test | | | | | X | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Field Testing | | | | | X | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Test Reports | | | | | X | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Cable Installation Reports | | | | | X | | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Materials and Equipment | | | | | | X | | | | X | | | | | | | | | | | | | | |
| | | | 1.3 | Cable Splicer Qualification | | | | | | X | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Cable Installer Qualifications | | | | | | X | | | | | | X | | | | | | | | | | | | |
| | | | 1.3 | Electrical Distribution System | | | | | | | | | X | | X | | | | | | | | | | | | | |

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

16415

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

16670

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

16710

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

16711

[illegible]

(ER 415 1-10)

| | |
|--------------|--|
| CONTRACT NO. | |
|--------------|--|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

16721

[illegible]

(ER 415 1-10)

| |
|--------------|
| CONTRACT NO. |
|--------------|

TITLE AND LOCATION

| |
|------------|
| CONTRACTOR |
|------------|

SPECIFICATION SECTION

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

16760

[illegible]

(ER 415 1-10)

SPECIFICATION SECTION

16770

| |
|------------|
| CONTRACTOR |
|------------|

QUALIFICATION TRAINING RANGE, FT. KNOX, KY

[illegible]

STATEMENT AND ACKNOWLEDGMENT

FORM APPROVED OMB NO
9000-0014

Public reporting burden for this collection of information is estimated to average .15 hours per response, including the time for reviewing instructions. Searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the suggestions for reducing this burden, to the FAR Secretarial (VRS), Office of Federal Acquisition and Regulatory Policy, GSA Washington, D.C. 20405: and to the Office of Management and Budget, Paperwork Reduction Project (9000-0014), Washington, D.C. 20503

PART I - STATEMENT OF PRIME CONTRACTOR

| | | |
|--|-----------------------------|---|
| 1. PRIME CONTRACT NO. | 2. DATE SUBCONTRACT AWARDED | 3. SUBCONTRACT NUMBER |
| 4. PRIME CONTRACTOR (Name, address and ZIP code) | | 5. SUBCONTRACTOR (Name, address and ZIP code) |
| 6. The prime contractor states that under the contract shown in item 1, a subcontract was awarded on date shown in item 2 by (Name of Awarding Firm) | | |

to the subcontractor identified in item 5, for the following work:

| | | |
|-------------------------------------|--------------------|-----------------|
| 7. PROJECT | 8. LOCATION | |
| 9. NAME AND TITLE OF PERSON SIGNING | 10. BY (Signature) | 11. DATE SIGNED |

PART II - ACKNOWLEDGMENT OF SUBCONTRACTOR

12. The subcontractor acknowledges that the following clauses of the contract shown in item 1 are included in this subcontract:

| | |
|-------------------------------------|--------------------------------------|
| Contract Work Hours and Safety | David-Bacon Act |
| Standards Act - Overtime | Apprentices and Trainees |
| Compensation - Construction | Compliance with Copeland Regulations |
| Payrolls and Basic Records | Subcontracts |
| Withholding of Funds | Contract Termination-Debarment |
| Disputes Concerning Labor Standards | Certification of Eligibility |

13. NAME(S) OF ANY INTERMEDIATE SUBCONTRACTORS, IF ANY

| | | |
|--------------------------------------|--------------------|-----------------|
| 14. NAME AND TITLE OF PERSON SIGNING | 15. BY (Signature) | 16. DATE SIGNED |
|--------------------------------------|--------------------|-----------------|

24 October 1988

(Sample of Typical contractor Quality report)

CONTRACTOR'S NAME
(Address)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Contract No: _____ Date: _____ Report No. _____
Project Name _____
Weather: (Clear) (P. Cloudy) (Cloudy); Temperature: _____Min. _____Max; _____Rainfall _____in.

| <u>Contractor/Subcontractors/Supplier</u> | <u>Area of Responsibility</u> |
|---|-------------------------------|
| a. _____ | _____ |
| b. _____ | _____ |
| c. _____ | _____ |
| d. _____ | _____ |
| e. _____ | _____ |
| f. _____ | _____ |
| g. _____ | _____ |

1. Definable Features of Construction in Progress: (Give briefly only definable features of work in progress and location. Refer to work performed by prime and/or subcontractor and/or supplier by letter in table above).

-
2. Material and/or Equipment Delivered to site: _____

-
3. Results of Surveillance: _____

Preparatory Phase (Attach minutes):

Initial Phase (Attach minutes):

Follow-up Phase (Include satisfactory work completed and/or deficiencies with action to be taken):

24 October 1988

4. Tests Required by Plans and/or Specification Performed and results of Test:
(Attach results of test taken on previous dates).

-
5. Verbal Instructions Received: (List any instructions given by Government Personnel on construction deficiencies. Retesting required, etc., with action to be taken).

-
6. Safety Deficiencies Noted. (Describe corrective actions taken).

-
7. Remarks: (Cover any conflicts in plans, specifications, or instruction).

CONTRACTOR'S VERIFICATION: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Contractor's Authorized QC Representative

All Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the Contracting Officer and shall conform to the size, format and typographic standards shown.

The sign panels are to be fabricated from .75" High Density Overlay Plywood.

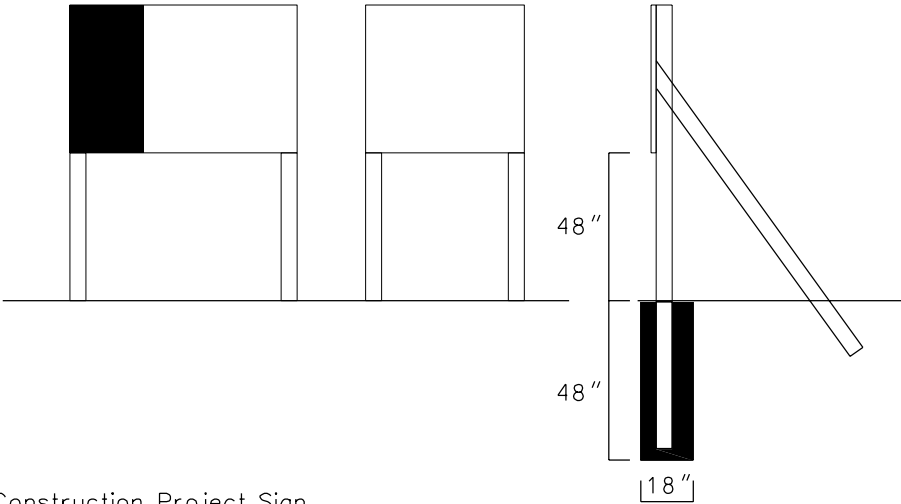
All graphics are to be applied to the background panel following the graphic formats as indicated.

Drill and insert six (6) .375" T-nuts from the front face of the HDO sign panel. Flange or T-nut to be flush with sign face.

Apply lettering and logo to prepared HDO plywood panel.

Sign uprights to be structural grade 4"x4" treated Douglas Fir or Southern Yellow Pine, No.1 or better. Post to be 12' long. Drill six (6) align with T-nuts in sign panel. Counterbore (.5') back of holes to accept socket head cap screw (4"x.375").

Assemble sign panel and uprights. Embed assembled sign panel and uprights in 4' holes. Bolt additional 2"x4" struts on inside face of uprights to reinforce installation as shown



Construction Project Sign
Legend Group 1: Corps Relationships

1. _____
2. _____

Legend Group 2: Corps Signature

1. U.S. Army Corps
2. of Engineers

Legend Group 2A: District Name

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____

Legend Group 4: Facility Name

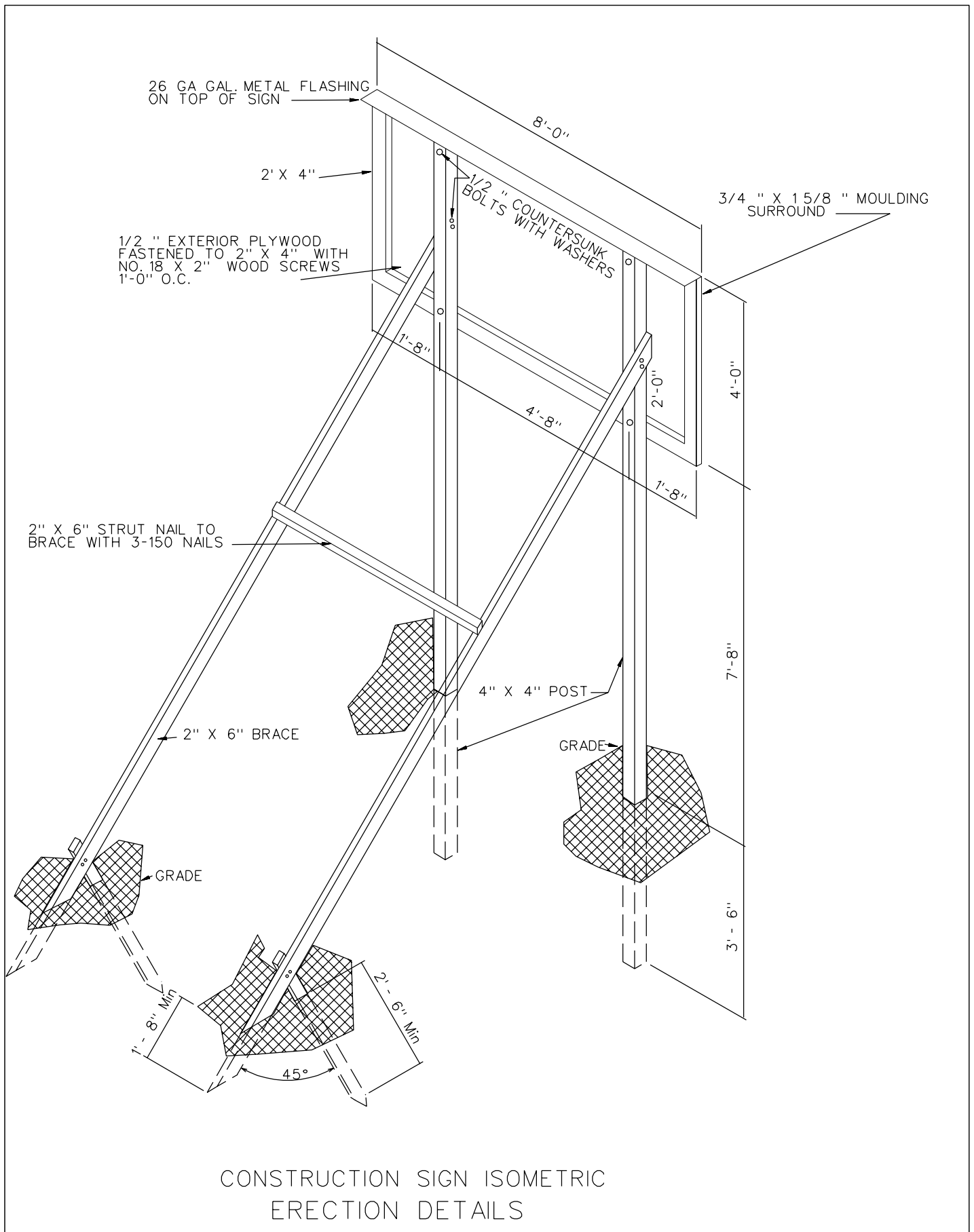
1. _____
2. _____

Legend Group 5a: Designer

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor

1. _____
2. _____
3. _____
4. _____
5. _____



Introduction: Project Identification Sign

Below are two samples of the construction project identification sign showing how this panel is adaptable for use to identify either civil works projects with a local sponsor (top) or military (bottom). The graphic format for this 4'x6' sign panel follows the legend guidelines and layout as specified

below. The large 4'x4' section of the panel on the right is to be white with black legend. For the top sign, the upper left 2'x2' section of the sign with the full Corps signature is to be painted Communications Red with white lettering. The lower left 2'x2' section of the sign shall match the local sponsor's colors

with white lettering. For the bottom sign, the 2'x4' left section of the sign with full Corps signature is to be painted Communications Red with white lettering. Mounting and fabrication details are provided.

Legend Group 1: One-to Two-line description of Corps relationship to project.

Color: White

Typeface: 1.25" Helvetica Regular Maximum line length: 19"

Legend Group 2: Two-line Corps Signature (US Army Corps of Engineers). Placed below Corps Castle

Color: White

Typeface: Helvetica Bold

Legend Group 2a:

District Name. Placed below

Signature (6: Castle).

Color: White

Typeface: 1.25" Helvetica Regular

Legend Group 3: Words "Local Sponsor"

Color: White

Typeface: 1.2" Helvetica Regular

Maximum length: 19"

Legend Group 4: One-to-three lines for name of local sponsor

Color: White

Typeface: 1.5" Helvetica Regular

Legend Group 5: One-to three-line project title legend describes the work being done under this contract.

Color: Black

Typeface: 3' Helvetica Bold

Maximum line length: 42"

Legend Group 6: One-to two-line identification of project or facility (civil works) or name of sponsoring department (military).

Color: Black

Typeface: 1.5" Helvetica Regular

Maximum line length: 42"

Cross-align the first line of Legend Group 5 with the first line of the /Corps Signature (US Army Corps) as shown.

Legend Groups 7a-b: One-to five-line identification of prime contractors including: type

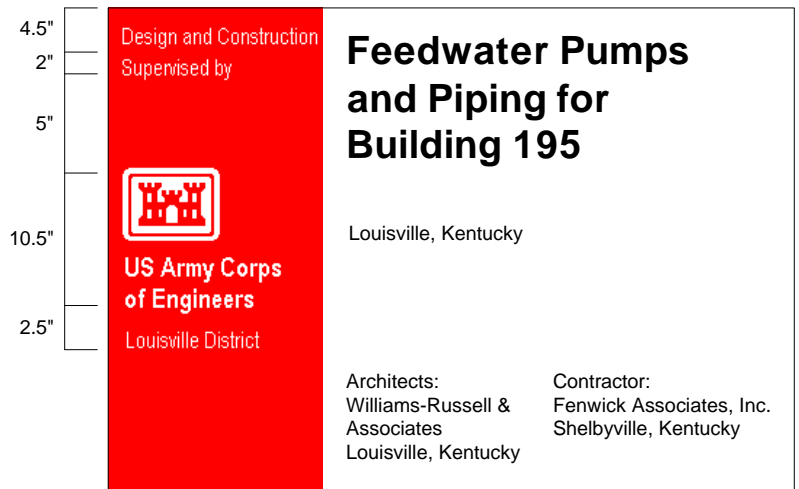
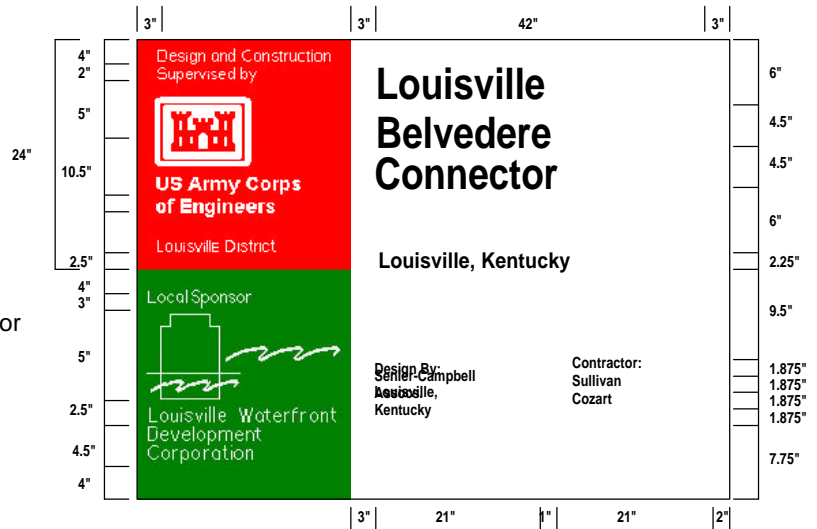
general contractor, etc.) corporate or firm name, city, state.

Color: Black

Typeface: 1.25" Helvetica Regular

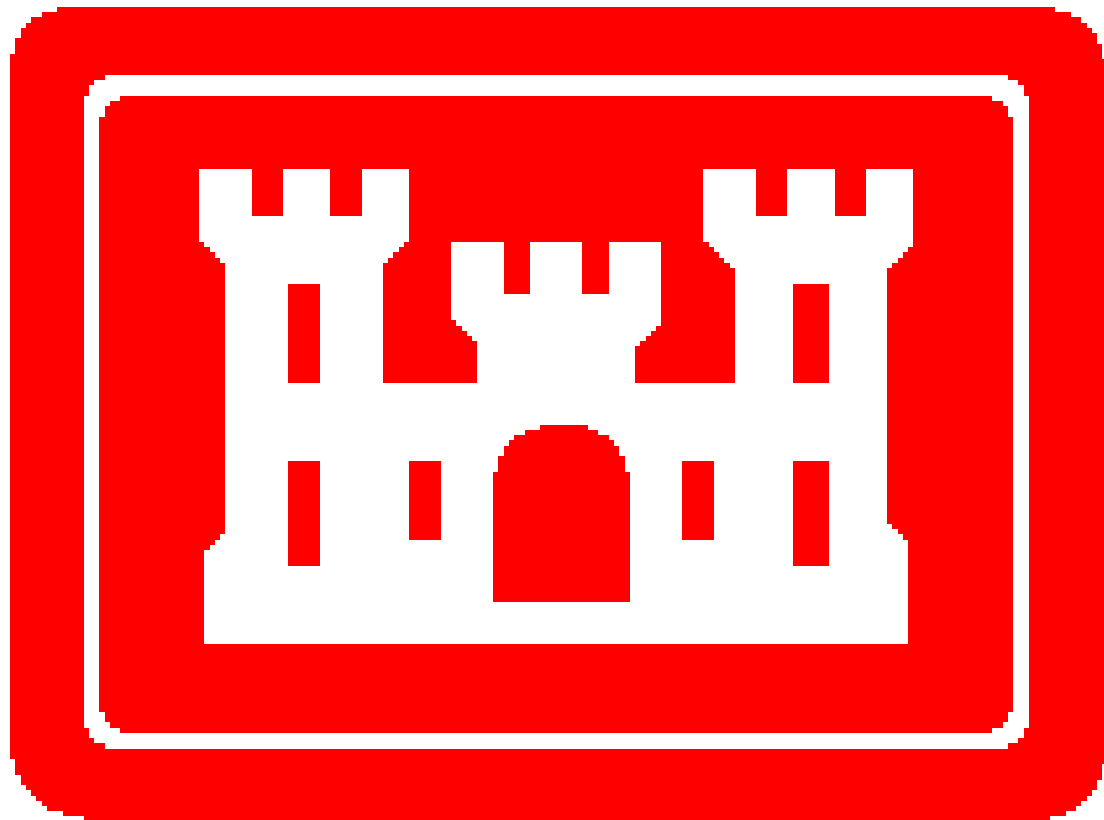
Maximum line length: 21"

Sponsor
Logo



| Legend Size | Panel Size | Post Size | Mounting Height | Color Bkg/Lgd |
|-------------|------------|-----------|-----------------|---------------|
| Various | 4'x6' | 4"x4" | 48" | WH-DR/BK |

All typography is flush left and rag right, upper and lower case with initial capitals only as shown.



**US Army Corps
of Engineers
Louisville District**

| | | | | | | | | | |
|---|--|--|---|---------------|--|----|---|---|-----------------|
| TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE <i>(Read instructions on the reverse side prior to initiating this form)</i> | | | | | DATE | | TRANSMITTAL NO. | | |
| SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS <i>(This section will be initiated by the contractor)</i> | | | | | | | | | |
| TO: | | | FROM: | | CONTRACT NO. | | CHECK ONE: <input type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____ | | |
| SPECIFICATION SEC. NO. <i>(Cover only one section with each transmittal)</i> | | | PROJECT TITLE AND LOCATION | | | | CHECK ONE: THIS TRANSMITTAL IS FOR FIO <input type="checkbox"/> GOV'T <input type="checkbox"/> APPROVAL | | |
| ITEM NO. | DESCRIPTION OF ITEM SUBMITTED <i>(Type size, model number/etc.)</i> | | MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. <i>(See Instruction no. 8)</i> | NO. OF COPIES | CONTRACT REFERENCE DOCUMENT | | FOR CONTRACTOR USE CODE | VARIATION <i>(See instruction no. 6)</i> | FOR CE USE CODE |
| a. | b. | | c. | d. | e. | f. | g. | h. | i. |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| REMARKS | | | | | I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated <div>NAME AND SIGNATURE OF CONTRACTOR</div> | | | | |
| SECTION II - APPROVAL ACTION | | | | | | | | | |
| ENCLOSURES RETURNED <i>(List by Item No.)</i> | | | NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY | | | | DATE | | |

Instructions

1. Section I will be initiated by the contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; in resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
5. Separate transmittal form will be used for submittals under separate section of the specifications.
6. a check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications—also, a written statement to that effect shall be included in the space provided for "Remarks."
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g. to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

- A – Approved as submitted.
 - B – Approved, except as noted on drawings.
 - C – Approved, except as noted on drawings. Refer to attached sheet resubmission required.
 - D – Will be returned by separate correspondence.
 - E – Disapproved (See attached).
 - F – Receipt acknowledged.
 - FX – Receipt acknowledged, does not comply as noted with contract requirements.
 - G – Other (*Specify*)
10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG form 4025-R)

EQUIPMENT-IN-PLACE LIST

Contract No. _____

Description of Item: _____

Model No: _____

Serial No: _____

Capacity: _____

Name of Mfg: _____

Condition: _____

Checked by: _____ Replacement Cost _____

Description of Item: _____

Model No: _____

Serial No: _____

Capacity: _____

Name of Mfg: _____

Condition: _____

Checked by: _____ Replacement Cost _____

Description of Item: _____

Model No: _____

Serial No: _____

Capacity: _____

Name of Mfg: _____

Condition: _____

Checked by: _____ Replacement Cost _____

PROJECT TABLE OF CONTENTS

SECTION 00800 SPECIAL CONTRACT REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

01010 SUMMARY OF WORK
01310 PROJECT SCHEDULE
01330 SUBMITTAL DESCRIPTIONS
01410 ENVIRONMENT PROTECTION
01451 CONTRACTOR QUALITY CONTROL
01500 TEMPORARY CONSTRUCTION FACILITIES

DIVISION 02 - SITE WORK

02050 DEMOLITION
02130 KPDES PERMIT FOR CONSTRUCTION
02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS
02230 CLEARING AND GRUBBING
02233 GRADED-CRUSHED-AGGREGATE BASE COURSE
02275 FILTER FABRIC
02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
02360 STEEL H-PILES
02450 TIMBER TIES, BALLAST, AND GEOGRID
02660 WATER DISTRIBUTION SYSTEM
02720 STORM-DRAINAGE SYSTEM
02740 SEPTIC SYSTEM
02752 SIPHONS, DOSING
02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS
02831 CHAIN LINK FENCE
02836 TRAFFIC SIGNS
02935 TURF
02950 TREES, SHRUBS, GROUND COVERS, AND VINES

DIVISION 03 - CONCRETE

03100 STRUCTURAL CONCRETE FORMWORK
03200 CONCRETE REINFORCEMENT
03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
03300 CAST-IN-PLACE STRUCTURAL AND MINOR CONCRETE

DIVISION 04 - MASONRY

04200 MASONRY

DIVISION 05 - METALS

05055 WELDING, STRUCTURAL
05120 STRUCTURAL STEEL
05300 STEEL DECKING
05500 MISCELLANEOUS METAL

TABLE OF CONTENTS (CONT.)

DIVISION 06 - WOODS & PLASTICS

06100 ROUGH CARPENTRY
06200 FINISH CARPENTRY

DIVISION 07 - THERMAL & MOISTURE PROTECTION

07311 ROOFING, STRIP SHINGLES
07416 STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
07600 SHEET METALWORK, GENERAL
07900 JOINT SEALING

DIVISION 08 - DOORS & WINDOWS

08110 STEEL DOORS AND FRAMES
08210 WOOD DOORS
08510 STEEL WINDOWS
08520 ALUMINUM WINDOWS
08700 BUILDERS' HARDWARE
08810 GLASS AND GLAZING

DIVISION 09 - FINISHES

09250 GYPSUM WALLBOARD
09900 PAINTING, GENERAL

DIVISION 10 - SPECIALTIES

10800 TOILET ACCESSORIES

DIVISION 12 - FURNISHINGS

12338 ARCHITECTURAL WOODWORK

DIVISION 13 - SPECIAL CONSTRUCTION

13121 METAL BUILDING SYSTEMS

DIVISION 15 - MECHANICAL

15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS
15400 PLUMBING, GENERAL PURPOSE
15488 GAS PIPING SYSTEMS
15566 WARM AIR HEATING SYSTEMS
15653 AIR-CONDITIONING SYSTEM (UNITARY TYPE)
15895 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS
15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

TABLE OF CONTENTS (CONT.)

DIVISION 16 - ELECTRICAL

16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL
16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
16415 ELECTRICAL WORK, INTERIOR
 Appendix A - Light Fixtures
16670 LIGHTNING PROTECTION SYSTEM
16710 PREMISES DISTRIBUTION SYSTEM
16711 TELEPHONE SYSTEM, OUTSIDE PLANT
16721 FIRE DETECTION AND ALARM SYSTEM
16725 INTRUSION DETECTION SYSTEMS
16760 INTERCOMMUNICATION SYSTEM
16770 RADIO AND PUBLIC ADDRESS SYSTEMS

APPENDIX A - GEOTECHNICAL INFORMATION

-- End of Project Table of Contents --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 RANGE

3.2 FINAL CLEANUP

3.3 DE-DUDDING RANGE WORK AREAS

3.4 OPTIONAL BID ITEMS

-- End of Section Table of Contents --

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

The support facilities include a main range control tower with two (2) control levels, a high explosive tower, two (2) general instruction buildings, two (2) latrines, three (3) ammunition breakdown buildings, three (3) covered bleachers with bleacher insets, intrusion detection system, range flag pole, crushed rock staging areas, vehicle staging and parking areas, walks, crushed rock roads, primary power, secondary power, data distribution, service roads, limit markers, lane markers, and site improvements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 RANGE

The size of the range is approximately 2,200 meters by 1,500 meters. The construction will include a few miles of access service roads, 28 firing positions, earth berm with timber retaining wall and target storage building for 1 moving armor target system, siting for 72 stationary armor target systems, 270 stationary infantry target systems, and 54 hard targets, 23 personnel, 25 tanks, three 2-man bunkers, and 3 zero targets). The roads are to be of crushed rock. Drainage course crossings are to be corrugated steel pipe culvert as indicated. Site grading for drainage and line of sight requirements will be included.

3.2 FINAL CLEANUP

Prior to acceptance, all areas within the project limits shall be cleared of all temporary work and disturbed areas not otherwise improved shall be seeded.

3.3 DE-DUDDING RANGE WORK AREAS

Heins Rifle, Lawley, and O'Brien Ranges are sited in the Fort Knox Impact Area. This area has been used as an impact area since early World War II for all types of ordnance. A surface clearance of the project site will be made by Army EOD technicians.

Items that have been identified include:

| <u>TYPE OF ORDNANCE</u> | <u>DEPTH PENETRATION</u> |
|--|--------------------------|
| Ctg., 20 mm High Explosive Incendiary | Surface to 3" |
| Proj., 20 mm High Explosive Incendiary | Surface to 3" |
| Ctg., 20 mm Target Practice w/Tracer | Surface to 3" |
| Proj., 40 mm High Explosive | Surface |
| Proj., 75 mm Armor Piercing | Surface to 1' |

| <u>TYPE OF ORDNANCE</u> | <u>DEPTH PENETRATION</u> |
|--|--------------------------|
| Proj., 75 mm Armor Piercing | Surface to 6" |
| Proj., 105 mm High Explosive | Surface to 3' |
| Proj., 105 mm Illumination | Surface to 3' |
| Proj., 106 mm High Explosive Anti-Tank | Surface to 1' |
| Proj., 155 mm High Explosive | Surface to 4' |
| Rocket, 2.75 in High Explosive | Surface to 1' |
| Missile, TOW Prac | Surface |
| Mortar, 81 mm | Surface to 1' |

During the QTR construction contract, ordnance may be found at the depths indicated above. The contractor should allow that his forces will find (2) items per day of work. A large quantity of trash (projectile casings, aerial dropped dispenser halves, and all sizes of fragmentation) still lie on the surface. Many inert practice ordnances may also be encountered.

Contractor personnel will be required to attend a course on Unexploded Ordnance (UXO) Identification, Safety, and Required Reporting Procedures of Suspected UXO. The course shall be held within 21 days after notice to proceed. Once a UXO is discovered, the contractor shall immediately notify the Area Engineer and cease work in the vicinity of the UXO.

Once notified of an UXO, the Area Engineer will notify the Explosive Ordnance Disposal (EOD) team at Fort Knox. The EOD personnel shall leave their unit at Fort Knox within 30 minutes during duty hours; after duty hours, within one hour.

During the course of work on this project, the contractor may encounter ordnance fragments and debris. It shall be the responsibility of the Construction Contractor to dispose of all non-UXO items as directed by the Contracting Officer.

It shall also be the responsibility of the Construction Contractor to move or dispose of ordnance fragments and debris as directed by the Contracting Officer after detonation of the UXO items of the EOD personnel.

Excavation on this project will not be allowed until each field employee has attended the safety course given by the EOD personnel. Subsequent new field employees shall also attend the safety course.

The Safety Officer for the contractor shall be notified by the Area Engineer prior to each detonation.

Ordnance removal by the EOD may require moving of the UXO to a remote area. This remote area shall be in the Spoils Area/Waste Disposal Area indicated in the plans.

Cooperation with the EOD personnel during UXO removal is essential.

3.4 OPTIONAL BID ITEMS

1. Headquarters Building with intrusion detection system.
2. Range Support Building with intrusion detection system.
3. Latrine Shower Building with potable water source and septic tank.
4. Two (2) covered mess.

5. Parts Storage Building.
6. Ten (10) tent pads with framed tent.
7. Firing position turning pads.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01310

PROJECT SCHEDULE

PART 1 GENERAL

1.1 PROGRESS CHART

-- End of Section Table of Contents --

SECTION 01310

PROJECT SCHEDULE

PART 1 GENERAL

1.1 PROGRESS CHART

The progress chart to be prepared by the Contractor pursuant to the clause entitled "Schedule for Construction Contracts" shall consists of a bar chart diagram with "s" curve.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01330

SUBMITTAL DESCRIPTIONS

PART 1 GENERAL

- 1.1 SUBMITTALS
- 1.2 SUBMITTAL CLASSIFICATION
 - 1.2.1 Government Approved
 - 1.2.2 Information Only
- 1.3 APPROVED SUBMITTALS
- 1.4 DISAPPROVED SUBMITTALS
- 1.5 WITHHOLDING OF PAYMENT

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 SUBMITTAL REGISTER (ENG FORM 4288)
- 3.3 SCHEDULING
- 3.4 TRANSMITTAL FORM (ENG FORM 4025)
- 3.5 SUBMITTAL PROCEDURE
 - 3.5.1 Procedures
 - 3.5.2 Deviations
- 3.6 CONTROL OF SUBMITTALS
- 3.7 GOVERNMENT APPROVED SUBMITTALS
- 3.8 INFORMATION ONLY SUBMITTALS
- 3.9 STAMPS

-- End of Section Table of Contents --

SECTION 01330

SUBMITTAL DESCRIPTIONS

PART 1 GENERAL

1.1 SUBMITTALS

The submittals described below are those required and further described in other sections of the specifications. Other requirements pertaining to submittals are included in the SPECIAL CLAUSES and Section 1330 SUBMITTAL PROCEDURES. Submittals required by the CONTRACT CLAUSES and other nontechnical parts of the contract are not included in this section.

SD-01 Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-06 Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-07 Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

SD-08 Statements

A document, required of the contractor, or through the contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-09 Reports

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

SD-13 Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product,

system or material meets specified requirements. The statement must be dated after the award of this contract, must state the contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.

SD-14 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-18 Records

Documentation to record compliance with technical or administrative requirements.

SD-19 Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.2.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.3 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the CQC requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall

be given promptly to the Contracting Officer.

1.5 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each item shall be stamped, signed, and dated by the CQC representative indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.

3.2 SUBMITTAL REGISTER (ENG FORM 4288)

At the end of this section is one set of ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications. Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" and submit 3 complete copies of the forms to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated. Copies of updated or corrected listings shall be submitted to the Contracting Officer at least every 60 days in the quantity specified.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached at the end of Section

H shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Procedures

The Contractor shall submit to the Contracting Officer 8 copies of all submittals of items requiring shop inspection and 6 copies of all other submittals as called for under the various heading of these specifications.

3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Three copies of the submittal will be retained by the Contracting Officer and 3 copies of the submittal will be returned to the Contractor.

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

| | |
|------------------|--|
| CONTRACTOR | |
| (Firm Name) | |
| _____ | Approved |
| _____ | Approved with corrections as noted on submittal data and/or attached sheets(s). |
| SIGNATURE: _____ | |
| TITLE: _____ | |
| DATE: _____ | |

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01410

ENVIRONMENT PROTECTION

- 1.1 GENERAL REQUIREMENTS
 - 1.1.1 Subcontractors
 - 1.1.2 Environmental Protection Plan
 - 1.1.3 Permits
 - 1.1.4 Preconstruction Survey
 - 1.1.5 Meetings
 - 1.1.6 Notification
 - 1.1.7 Litigation
 - 1.1.8 Previously Used Equipment
 - 1.1.9 Payment
 - 1.2 LAND RESOURCES
 - 1.2.1 Work Area Limits
 - 1.2.2 Landscape
 - 1.2.3 Unprotected Erodible Soils
 - 1.2.4 Disturbed Areas
 - 1.2.5 Contractor Facilities and Work Areas
 - 1.3 WATER RESOURCES
 - 1.3.1 Washing and Curing Water
 - 1.3.2 Cofferdam and Diversion Operations
 - 1.3.3 Stream Crossings
 - 1.3.4 Fish and Wildlife
 - 1.4 AIR RESOURCES
 - 1.4.1 Particulates
 - 1.4.2 Hydrocarbons and Carbon Monoxide
 - 1.4.3 Odors
 - 1.4.4 Sound Intrusions
 - 1.5 WASTE DISPOSAL
 - 1.5.1 Solid Wastes
 - 1.5.2 Chemical Wastes
 - 1.5.3 Hazardous Wastes
 - 1.5.4 Burning
 - 1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
 - 1.7 POST CONSTRUCTION CLEANUP
 - 1.8 RESTORATION OF LANDSCAPE DAMAGE
 - 1.9 MAINTENANCE OF POLLUTION FACILITIES
 - 1.10 TRAINING OF CONTRACTOR PERSONNEL
- PART 2 PRODUCTS (Not Applicable)
- PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01410

ENVIRONMENT PROTECTION

1.1 GENERAL REQUIREMENTS

The Contractor shall perform the work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

1.1.1 Subcontractors

The Contractor shall ensure compliance with this section by subcontractors.

1.1.2 Environmental Protection Plan

The Contractor shall submit an environmental protection plan within 15 days after receipt of the notice to proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include, but shall not be limited to, the following:

- a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- b. Methods for protection of features to be preserved within authorized work areas like trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.
- c. Procedures to be implemented to provide the required environmental protection, to comply with the applicable laws and regulations, and to correct pollution due to accident, natural causes, or failure to follow the procedures of the environmental protection plan.
- d. Location of the solid waste disposal area.
- e. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess

or spoil materials.

- f. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
- g. Traffic control plan including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather, and the amount of mud transported onto paved public roads by vehicles or runoff.
- h. Methods of protecting surface and ground water during construction activities.
- i. Plan showing the proposed activity in each portion of the work area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.
- j. Drawing of borrow area location. Protection measures required at the work site shall apply to the borrow areas including final restoration for subsequent beneficial use of the land.
- k. A recycling and waste prevention plan with a list of measures to reduce consumption of energy and natural resources; for example: the possibility to shred fallen trees and use them as mulch shall be considered as an alternative to burning or burial.
- l. A settling pond removal plan 120 days prior to removal work. The plan shall include the method of removing and testing of the collected sediment.
- m. Training for Contractor's personnel during the construction period.

1.1.3 Permits

The Contractor shall obtain all needed permits or licenses. The Government will not obtain any permits for this project; see Contract Clause PERMITS AND RESPONSIBILITIES. The State department of natural resources, through the national pollutant discharge elimination system (NPDES), requires general permits, a notice of intent, and a notice of discontinuation. The Contractor shall be responsible for implementing the terms and requirements of the appropriate permits as needed and for payment of all fees.

1.1.4 Preconstruction Survey

Prior to starting any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to work sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the Contracting Officer and the Contractor upon mutual agreement as to its accuracy and completeness.

1.1.5 Meetings

The Contractor shall meet with representatives of the Contracting Officer to alter the environmental protection plan as needed for compliance with the environmental pollution control program.

1.1.6 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

1.1.7 Litigation

If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, the Contracting Officer will determine whether the order is due in any part to the acts or omissions of the Contractor, or subcontractors at any tier, not required by the terms of the contract. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by the Contracting Officer in the administration of the contract under the contract clause SUSPENSION OF WORK.

1.1.8 Previously Used Equipment

The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present; the Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

1.1.9 Payment

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the contract unit and/or lump sum prices in the Bidding Schedule.

1.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

1.2.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted

during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

1.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

1.2.3 Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the developed areas as approved by the Contracting Officer.

1.2.4 Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

- a. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.
- b. Erosion and sedimentation control devices. The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as indicated on the drawings. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.
- c. Sediment basins. Sediment from construction areas shall be trapped in temporary or permanent sediment basins in accordance with the drawings. The basins shall accommodate the runoff of a local 5 year storm. After each storm, the basins shall be pumped dry and accumulated sediment shall be removed to maintain basin effectiveness. Overflow shall be controlled by paved weirs or by vertical overflow pipes. The collected topsoil sediment shall be reused for fill on the construction site, and/or stockpiled for use at another site. The Contractor shall institute effluent quality monitoring programs as required by State and local environmental agencies.

1.2.5 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering

nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

1.3 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

1.3.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. Waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates to separate pollutants from the water. Analysis shall be performed and results reviewed and approved before water in retention ponds is discharged.

1.3.2 Cofferdam and Diversion Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and on water quality for downstream use.

1.3.3 Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State or local government.

1.3.4 Fish and Wildlife

The Contractor shall minimize interference with, disturbance to, and damage of fish and wildlife. Species that require specific attention along with measures for their protection shall be listed by the Contractor prior to beginning of construction operations.

1.4 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be the Contractor's responsibility. All air areas affected by the construction activities shall be monitored by the Contractor. Monitoring results will be periodically reviewed by the Government to ensure compliance.

1.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

1.4.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

1.4.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

1.4.4 Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize environment damage by noise.

1.5 WASTE DISPOSAL

Disposal of wastes shall be as specified in Section 02050 DEMOLITION as specified below.

1.5.1 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

1.5.2 Chemical Wastes

Chemicals shall be dispensed ensuring no spillage to ground or water. Periodic inspections of dispensing areas to identify leakage and initiate corrective action shall be performed and documented. This documentation will be periodically reviewed by the Government. Chemical waste shall be collected in corrosion resistant, compatible containers. Collection drums shall be monitored and removed to a staging or storage area when contents are within 6 inches of the top. Wastes shall be disposed of in accordance with Federal and local laws and regulations.

1.5.3 Hazardous Wastes

The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing compatibility. The Contractor shall transport hazardous waste off Government property and dispose of it in compliance with Federal and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills shall be the Contractor's responsibility.

1.5.4 Burning

Burning will be allowed only if permitted in other sections of the specifications or authorized in writing by the Contracting Officer. The specific time, location, and manner of burning shall be subject to approval. Fires shall be confined, guarded at all times, and shall be under constant surveillance until they have burned out or have been extinguished. Burning shall be thorough, reducing the materials to ashes.

1.6 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out.

The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer.

1.7 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

1.8 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas.

1.9 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

1.10 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 PAYMENT

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 QUALITY CONTROL PLAN
 - 3.2.1 General
 - 3.2.2 Content of the CQC Plan
 - 3.2.3 Acceptance of Plan
 - 3.2.4 Notification of Changes
- 3.3 COORDINATION MEETING
 - 3.3.1 Subcontractor CQC Orientation
- 3.4 QUALITY CONTROL ORGANIZATION
 - 3.4.1 General
 - 3.4.2 CQC System Manager
 - 3.4.3 CQC Personnel
 - 3.4.4 Additional Requirement
 - 3.4.5 Organizational Changes
- 3.5 SUBMITTALS
- 3.6 CONTROL
 - 3.6.1 Preparatory Phase
 - 3.6.2 Initial Phase
 - 3.6.3 Follow-up Phase
 - 3.6.4 Additional Preparatory and Initial Phases
- 3.7 TESTS
 - 3.7.1 Testing Procedure
 - 3.7.2 Testing Laboratories
 - 3.7.2.1 Capability Check
 - 3.7.2.2 Capability Recheck
 - 3.7.3 Onsite Laboratory
 - 3.7.4 Furnishing or Transportation of Samples for Testing
- 3.8 COMPLETION INSPECTION
 - 3.8.1 Punch-Out Inspection
 - 3.8.2 Pre-Final Inspection
 - 3.8.3 Final Acceptance Inspection
- 3.9 DOCUMENTATION
- 3.10 SAMPLE FORMS (GENERATED BY RMS SOFTWARE)
- 3.11 NOTIFICATION OF NONCOMPLIANCE

-- End of Section Table of Contents --

SECTION 01451

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM D 3740 | (1996) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction |
| ASTM E 329 | (1995b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction |

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than

30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.

- j. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting.

During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.3.1 Subcontractor CQC Orientation

Before a Subcontractor begins work on the jobsite, the CQC System Manager will train the Subcontractor by showing the video tape entitled "CQC - A Bridge (or Pathway) to Success" and answering any questions pertaining to quality control operations. This requirement is waived only if a Subcontractor attended the initial coordination meeting described above. A copy of this video can be borrowed from the Contracting Officer. A record of the orientation shall be documented in the QC Report.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate civil engineer, graduate architect, or a graduate of construction management, with a minimum of 10 years construction experience on construction similar to this contract. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, civil, structural, architectural, materials technician, and submittals clerk. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan.

Experience Matrix

| | Area | Qualifications |
|----|------------|--|
| a. | Civil | Graduate Civil Engineer with 10 years experience in the type of work being performed on this project |
| b. | Mechanical | Graduate Mechanical Engineer with 2 yrs experience or person with 10 yrs related experience |
| c. | Electrical | Graduate Electrical Engineer with 2 yrs related experience or person with 10 yrs related experience |

Experience Matrix

| | Area | Qualifications |
|----|-------------------------------|---|
| d. | Structural | Graduate Structural Engineer with 2 yrs experience or person with 10 yrs related experience |
| e. | Architectural | Graduate Architect with 2 yrs experience or person with 10 yrs related experience |
| f. | Submittals | Submittal Clerk with 1 yr experience |
| g. | Concrete, Pavements and Soils | Materials Technician with 2 yrs experience for the appropriate area |

3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager and his staff shall have completed the course entitled "Construction Quality Management For Contractors". This course is periodically offered by the Associated Builders and Constructors, Inc. or Associated General Contractor, Inc.

3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS

Submittals shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications.

- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Resolve all differences.
- k. Discussion of the initial control phase.
- l. The Government shall be notified at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.

- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall

be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of \$1,375.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the U.S. Army Engineer Waterways Experiment Station, f.o.b., at the following address:

Commander and Director
U.S. Army Engineer Waterways Experiment Station
ATTN: CEWES-GS
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement,

Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by

whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals reviewed, with contract reference, by whom, and action taken.
- g. Off-site surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.
- k. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.
- l. Deficiency Tracking System. The Contractor shall maintain a cumulative list of deficiencies identified for the duration of the project. Deficiencies to be listed include those failures, Governmental oral observations and Notifications of Noncompliance. The list shall be maintained at the project site. Copies of updated listings shall be submitted to the Government at least every 30 days.

3.10 SAMPLE FORMS (GENERATED BY RMS SOFTWARE)

Sample forms for Daily Construction Quality Control Report and Deficiency List are enclosed at the end of Section 00800 as well as other forms the Contractor may utilize during this project.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

- 1.1 GENERAL REQUIREMENTS
 - 1.1.1 Site Plan
 - 1.1.2 Identification of Employees
 - 1.1.3 Employee Parking
- 1.2 AVAILABILITY AND USE OF UTILITY SERVICES
 - 1.2.1 Payment for Utility Services
 - 1.2.2 Meters and Temporary Connections
 - 1.2.3 Advance Deposit
 - 1.2.4 Final Meter Reading
 - 1.2.5 Sanitation
 - 1.2.6 Telephone
- 1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN
 - 1.3.1 Bulletin Board
 - 1.3.2 Project and Safety Signs
- 1.4 PROTECTION AND MAINTENANCE OF TRAFFIC
 - 1.4.1 Haul Roads
 - 1.4.2 Barricades
- 1.5 CONTRACTOR'S TEMPORARY FACILITIES
 - 1.5.1 Administrative Field Offices
 - 1.5.2 Storage Area
 - 1.5.3 Supplemental Storage Area
 - 1.5.4 Appearance of Trailers
 - 1.5.5 Maintenance of Storage Area
 - 1.5.6 Security Provisions
- 1.6 PLANT COMMUNICATION
- 1.7 CLEANUP
- 1.8 RESTORATION OF STORAGE AREA

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

1.2.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meter bases required to measure the amount of each utility used for the purpose of determining charges. The

Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of \$50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.2.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.3.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after

receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5 CONTRACTOR'S TEMPORARY FACILITIES

1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.5.2 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored brown, so that visibility through the fence is obstructed.

Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.6 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.6 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.7 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.8 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02050

DEMOLITION

PART 1 GENERAL

- 1.1 GENERAL REQUIREMENTS
- 1.2 SUBMITTALS
- 1.3 DUST CONTROL
- 1.4 PROTECTION
 - 1.4.1 Protection of Personnel
 - 1.4.2 Protection of Existing Property
 - 1.4.3 Protection From the Weather
 - 1.4.4 Protection of Trees
 - 1.4.5 Environmental Protection
- 1.5 BURNING
- 1.6 USE OF EXPLOSIVES
- 1.7 AVAILABILITY OF WORK AREAS

PART 2 PRODUCTS Not Applicable

PART 3 EXECUTION

- 3.1 EXISTING STRUCTURES
- 3.2 UTILITIES
- 3.3 FILLING
- 3.4 DISPOSITION OF MATERIAL
 - 3.4.1 Salvageable Items and Material
 - 3.4.1.1 Material Salvaged for the Contractor
 - 3.4.1.2 Items Salvaged for the Government
 - 3.4.1.3 Items Salvaged for the Using Service
 - 3.4.1.4 Historical Items
 - 3.4.2 Unsalvageable Material
- 3.5 CLEAN UP
- 3.6 REMOVAL OF PBC TRANSFORMER
 - 3.6.1 Removal and Transportation of PBC's
 - 3.6.2 Description of Transformer
 - 3.6.3 Containment of PCB
 - 3.6.4 PCB Manifest
 - 3.6.5 Spillage of PCB's

-- End of Section Table of Contents --

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

PCB Transformers; GA.

Submit description of PCB transformers to be removed.

Manifests; GA.

Manifests of any PCB transformers to be transported.

SD-09 Reports

Test Reports; GA.

Results of test reports of PCB transformers.

SD-08 Statements

Work Plan; GA.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

1.3 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.4 PROTECTION

1.4.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, may be allowed to remain standing without additional bracing, shoring, or lateral support until demolished. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.4.2 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.4.3 Protection From the Weather

The interior of buildings to remain and salvageable materials and equipment shall be protected from the weather at all times.

1.4.4 Protection of Trees

Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 6 foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the

Contracting Officer.

1.4.5 Environmental Protection

The work shall comply with the requirements of Section 01410 ENVIRONMENTAL PROTECTION.

1.5 BURNING

The use of burning at the project site for the disposal of refuse and debris will be permitted in open areas as approved by the Contracting Officer during daylight hours.

1.6 USE OF EXPLOSIVES

Use of explosives is subject to approval by the Contracting Officer

1.7 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available after notice to proceed.

PART 2 PRODUCTS Not Applicable

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated shall be removed to grade. Concrete target slabs and other concrete structures shall be broken up and removed or used for riprap as directed. All existing target berms and indicated roads shall be leveled to natural ground. Cemeteries, including markers, fencing and access, shall not be disturbed. Demolition of existing rear area support buildings shall be performed by others.

3.2 UTILITIES

Disconnection of utility services with related equipment shall be removed as shown or indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.3 FILLING

Holes or other hazardous openings shall be filled in accordance with Section 02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS.

3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

3.4.1 Salvageable Items and Material

Contractor shall salvage items and material to the maximum extent possible.

3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

3.4.1.2 Items Salvaged for the Government

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents. The following items reserved as property of the Government shall be delivered to the areas designated: Transformers with potential PBC shall be turned into the post (DPW) central point area, munitions, ammunition residue, lighting protection, control panels, capacitor panels, power panels, and regulators.

3.4.1.3 Items Salvaged for the Using Service

The following items reserved as property of the using service will be removed prior to commencement of work under this contract: telephones located in the construction.

3.4.1.4 Historical Items

Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: corner stones, contents of corner stones, and document boxes wherever located on the site.

3.4.2 Unsalvageable Material

Concrete, masonry, metal and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the disposal area shown. After disposal is completed, the disposal area shall be uniformly graded to drain. Combustible material shall be disposed of off the site or by burning. All fluorescent ballasts removed shall be placed in a drum furnished by DEH and transported as directed by DEH for disposal.

3.5 CLEAN UP

Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

3.6 REMOVAL OF PBC TRANSFORMER

3.6.1 Removal and Transportation of PBC's

The Contractor shall furnish all labor, materials, and equipment necessary to remove and transport PCB contaminated transformers and other associated materials to the DEH for disposal. The Contractor shall be responsible for testing the transformers for PBC's.

All transportation will be in accordance with 49 CFR 761, as amended.

Polychlorinated Biphenyls (PCB) Manufacturing, Processing, Distribution in

Commerce and Use of Prohibitions.

3.6.2 Description of Transformer

A description of each transformer to include ID Number, manufacturer, voltage rating, gallons of dielectric fluid, weight, serial number, cubic feet, and PPM/PCB concentration shall be provided by the Contractor after the tests for PBC's are completed.

3.6.3 Containment of PCB

If necessary, the Contractor will use leak proof secondary containment pans with a minimum of 12 inch sides when transporting the PCB item to the DEH. The PCB containing items should be removed intact. That is, without removing the liquid from transformers.

3.6.4 PCB Manifest

A manifest of all PCB items/materials transported to the DEH shall be kept by the Contractor. The manifest should consist of a description of the items being disposed of as required in Paragraph "Description of Transformer"

3.6.5 Spillage of PCB's

Contractor is responsible for his actions resulting in the spillage of PCB's. Responsibilities include immediate containment, cleanup and disposal as well as sampling and analysis of spill area to ensure no residual contamination remains. Disposal shall consist of transporting spillage to the DEH in sealed drums marked as to content.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02130

KPDES PERMIT FOR CONSTRUCTION

PART 1 GENERAL

- 1.1 SUMMARY (NOT APPLICABLE.)
- 1.2 REFERENCES
- 1.3 GENERAL REQUIREMENTS
 - 1.3.1 Permit
 - 1.3.2 Practices
- 1.4 QUALITY ASSURANCE
- 1.5 SUBMITTALS
- 1.6 EXISTING SITE CONDITIONS
- 1.7 AFFECTED AREA
- 1.8 COEFFICIENT OF RUNOFF
- 1.9 RECEIVING WATERS
- 1.10 WETLANDS
- 1.11 STANDARD INDUSTRIAL CODE

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

- 3.1 PERMIT
 - 3.1.1 General
 - 3.1.2 Publications
 - 3.1.3 Certifications
- 3.2 GENERAL INSTRUCTIONS
 - 3.2.1 Stabilization Practices
 - 3.2.2 Structural Practices
 - 3.2.3 Dams or Dikes
 - 3.2.4 Sedimentation Basins
 - 3.2.5 Silt Checks
 - 3.2.6 Silt Traps
 - 3.2.7 Temporary Silt Fences
 - 3.2.8 Level Spreader
- 3.3 ADDITIONAL INSTRUCTIONS

-- End of Section Table of Contents --

SECTION 02130

KPDES PERMIT FOR CONSTRUCTION

PART 1 GENERAL

1.1 SUMMARY (NOT APPLICABLE.)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

| | |
|-----|---|
| EPA | EPA Publications 832-R-92005 (SEP 1992) Storm Water Management for Construction Activities - Developing Pollution Plans and Best Management Practices. |
|-----|---|

| | |
|-------|--|
| KPDES | KPDES Permit No. KYR 10000 "General Permit for Storm Water Point Sources Construction Authorization to Discharge Under the Kentucky Pollutant Discharge Elimination System." |
|-------|--|

1.3 GENERAL REQUIREMENTS

1.3.1 Permit

The work includes Contractor preparation and submittal to Kentucky Department of Environmental Protection (KDEP) a Notice of Intent (NOI) including all required information at least 48 hours prior to beginning operations, complying with all requirements of KPDES (Kentucky Pollutant Elimination System) Permit NO. KYR 100000 "General Permit for Stormwater Point Sources - Construction, and filing a Notice of Termination (NOT) when all stormwater discharges associated with construction on the site have been completed.

1.3.2 Practices

The contractor shall conduct all construction operations in accordance with the requirements of the Permit and the "Best Management Practices for Construction Activities."

1.4 QUALITY ASSURANCE

Provide qualified personnel to administer the pollution elimination plan and make all inspections and reports required.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300: SUBMITTALS

SD-18 Records

Storm Water General Permit; FIO.

Copies of all documents and correspondence pertaining to the KPDES General Permit for Construction activities shall be furnished to the Contracting Officer prior to or simultaneously with transmission to KDEP. Included shall be NOI (Notice of Intent) and all supporting documents, inspection reports, signed certifications, and NOT (Notice of Termination).

Contractor Inspectors; FIO

Submit names and qualifications of contractor personnel assigned to inspect disturbed area.

1.6 EXISTING SITE CONDITIONS

The Qualification Training Range is located on rolling terrain with Johnson Branch, a tributary of the Salt River discharging into the Ohio River, running along the eastern side of the range and separating the high explosive lanes from the non-high explosive lanes. Johnson Branch is subject to backwater from the Ohio River through the Salt River at an elevation of 445.5 in a 100 year flood. All primary facilities on the range will be located above the 100 Year Flood elevation.

Much of the existing trail system from Heins Rifle, Lawley, and O'Brien Ranges is poorly drained with drainage pattern only partially developed in relation to the future increased usage of the range area.

The vegetation on much of the range area is deciduous trees, scrub, and grasses of varying height.

The downrange area has been an impact area for many years and is reflected on the surface with craters, unexploded ordnance and metal fragments. Surface clearance will be provided by G3, Fort Knox Range Division.

1.7 AFFECTED AREA

The total area of the range site is approximately 600 acres. The approximate area to be cleared for line of sight and actual construction activities is 230 acres. The approximate area of soil disturbance is approximately 80 acres which is a variable depending on the contractor's method of construction and obtaining material for roadway and target berms.

1.8 COEFFICIENT OF RUNOFF

The coefficient of runoff for the site after construction and stabilization will essentially be the same as it is in its present condition. The number of target emplacements will increase significantly. The number of target roads will increase slightly. Once the vegetative cover is in place there will be slightly more exposed soil in the finished grade.

1.9 RECEIVING WATERS

Waters from the site flow into Johnson Branch, a tributary of the Salt River which empties into the Ohio River.

1.10 WETLANDS

There are no known wetlands on the construction site.

1.11 STANDARD INDUSTRIAL CODE

The SIC Code for Fort Knox is 9711.

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

3.1 PERMIT

3.1.1 General

The contractor (permittee) shall prepare a permit request in accordance with the rules for a General Permit for Stormwater Point Sources Construction KYR 100000 to obtain authorization to discharge under the Kentucky Pollutant Discharge Elimination System. A copy of the permit is attached in Appendix A of this section of the specifications. Please note Section 6 of Part IV does not apply to construction but all other sections are applicable. Two reproducible copies of the range at 1" = 200' will be furnished to the successful contractor as an aid in preparing the site plan portion of the Best Management Practices Plan. The drawings are a compilation of plan sheets C-1 to C-63.

3.1.2 Publications

EPA Publications 832-R-92005 (Sep 1992) "Stormwater Management for Construction Activities" and "Best Management Practices for Construction Activities" from KPDES contains guidelines for developing Stormwater Best Management Plans.

3.1.3 Certifications

The contractor and subcontractors identified with the plan shall sign certification statements as described in the permit instructions.

3.2 GENERAL INSTRUCTIONS

3.2.1 Stabilization Practices

Methods of establishing vegetation are indicated in Section 02935 TURF. Contractor shall immediately commence temporary or permanent turf operation whenever grading work is completed or stopped for a period of 14 days or more.

3.2.2 Structural Practices

Structural practices shall be put in place prior to exposing erodible soil. These practices include as a minimum:

3.2.3 Dams or Dikes

Dams or dikes constructed of crushed stone, broken rock, soil or straw, or excavated pits, constructed to retard the flow of water which is laden with eroded material in a manner to cause eroded material to settle in the pits or behind the dams or dikes. Silt checks, silt straps, sedimentation basins, and silt fences shall be constructed before major earth excavation takes place and wherever it appears that eroded material will pollute Johnson Branch or other tributaries.

3.2.4 Sedimentation Basins

Sedimentation basins shall include construction of an earth, or rock and earth, dam with designated spillway or spillways to form a sedimentation basin. The removal of accumulated silt as required, and any maintenance necessary to ensure proper functioning of the basins until acceptance of the project is mandatory.

The purpose of a sedimentation basin is to control the discharge of silt laden water during the construction period. For this reason, the Contractor shall construct the sedimentation basin as his first grading operation in the drainage area. The dams shall be constructed of suitable earth placed in 6-inch lifts compacted to 95 percent of maximum density or of a combination of rock and earth placed as a rock embankment. The pipe and outlet riser shall be sized to accommodate flow anticipated through the basin.

Sedimentation basins may remain in place upon completion of the project as directed.

3.2.5 Silt Checks

Silt checks shall consist of:

- a. Straw bales, stacked so as to remain in place, placed in the numbers and at the locations designated.
- b. Crushed stone such as Cyclopean Stone Rip Rap, quarry run stone, or other size material approved as suitable for this use, dumped in place, at the locations designated and shaped to the configuration required.
- c. Blasted or broken rock dumped in place at the locations designated and shaped to the configuration required.

The contractor may select the type ditch check to be constructed at each location.

Sedimentation deposited at silt checks shall be removed and properly disposed of when deemed necessary. When their usefulness has ended, the silt checks shall be removed, surplus materials disposed of by spreading and the entire area disturbed shall be seeded and protected, as directed. Silt checks may remain in place upon completion of the project only when permitted by the Contracting Officer.

3.2.6 Silt Traps

Silt traps shall be constructed by excavating basins in natural or excavated channels, and shall be constructed as follows:

- a. Excavated pits, from 2 to 3 feet in depth, 20 to 30 feet in

length, and 5 to 10 feet in width.

- b. Excavated pits with the addition of a dike and overflow pipe. Dimensions of the pit and the overflow pipe shall be sized to accommodate anticipated flows.

Sediment deposited in silt traps shall be removed each time the silt trap is approximately 50 percent filled. When their usefulness has ended, the silt traps shall be removed, surplus materials disposed of by spreading and the entire area disturbed shall be seeded and protected as directed. Silt traps may remain in place upon completion of the project only when permitted by the Contracting Officer.

3.2.7 Temporary Silt Fences

Temporary silt fences shall be constructed by installation of posts, and installation of metal fence fabric and geotextile fabric, in accordance with the standard drawings.

Fence posts shall be at least 5 feet long, and metal fence fabric shall be at least 14 gage, 36 inches high, and with openings no larger than 6 inches x 6 inches. Geotextile fabric shall be a material recommended for this use by the manufacturer.

Fence posts and fabric will be accepted based on visual inspection by the Engineer in the field; geotextile fabric will be accepted upon receipt of a certification from the manufacturer that it is suitable for use as silt fence.

Silt fences shall be classified as major and minor. Minor silt fences shall differ only as to the use of wire support. The silt fence shall be erected before grading is begun in the area to be protected. Posts shall be installed at 6 to 10 feet spacing (the closer spacing should be used in areas where rapid run-off can be expected) and the fence fabric attached. The geotextile fabric shall be attached to the fence, on the upstream side, using staples, hog-rings, or another approved method. The bottom 12 inches of the fabric shall be buried in a 6-inch trench cut into the ground and covered by 6 inches of fill material, to prevent sediment escaping under the fence. All earthwork shall be on the upstream side of the fence.

During the useful life of the silt fence, it shall be maintained by the Contractor, and silt accumulations that threaten damage to the fence shall be removed. After the usefulness of the fence has ended it shall be removed and disposed of, the accumulated silt shall be either removed or dressed in place as directed, and the entire area shall be seeded and protected.

3.2.8 Level Spreader

Level spreaders are excavated depressions at zero percent grade across the slope to provide low velocity outlets for storm drain channels and other areas of concentrated runoff. The outlet side shall be undisturbed earth where the lower lip is stabilized by existing vegetation. Level spreaders shall have a minimum width of 6 feet and minimum length of 50 feet.

3.3 ADDITIONAL INSTRUCTIONS

- a. Soil disturbing activities shall be scheduled with regard to anticipated seasonable weather and daily weather conditions.

- b. Silt fences are required on all downhill slopes from soil disturbing activities.
- c. Utilize level spreaders on pipes and others as needed.
- d. Excavate and stabilize relocated channels along Johnson Branch before opening the ends to flow. Use temporary silt checks downstream of each relocation to trap silt when opening channels.
- e. Perform all equipment maintenance in a single area that has been prepared for containment of pollutants and graded to prevent stormwaters from entering the area.
- f. Provide employee training program to inform all employees of the components and goals of the Best Management Practice Plan including appropriate responses to situations capable of introducing pollutants into public waters.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
 - 1.2.1 Degree of Compaction
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Satisfactory Materials
 - 2.1.2 Unsatisfactory Materials
 - 2.1.3 Cohesionless and Cohesive Materials
- 2.2 CAPILLARY WATER BARRIER

PART 3 EXECUTION

- 3.1 CLEARING AND GRUBBING
- 3.2 TOPSOIL
- 3.3 EXCAVATION
- 3.4 DRAINAGE AND DEWATERING
 - 3.4.1 Drainage
 - 3.4.2 Dewatering
- 3.5 SHORING
- 3.6 CLASSIFICATION OF EXCAVATION
- 3.7 BLASTING
- 3.8 EXCAVATED MATERIALS
- 3.9 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE
- 3.10 SUBGRADE PREPARATION
- 3.11 FILLING AND BACKFILLING
- 3.12 TESTING
 - 3.12.1 In-Place Densities
 - 3.12.1.1 In-Place Density of Subgrades
 - 3.12.1.2 In-Place Density of Fills and Backfills
 - 3.12.2 Moisture Content
 - 3.12.3 Optimum Moisture and Laboratory Maximum Density
- 3.13 CAPILLARY WATER BARRIER
- 3.14 GRADING
- 3.15 SPREADING TOPSOIL
- 3.16 PROTECTION

-- End of Section Table of Contents --

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM D 1556 | (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.)) |
| ASTM D 2167 | (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| ASTM D 2216 | (1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock |
| ASTM D 2487 | (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 2922 | (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 2937 | (1994) Density of Soil in Place by the Drive-Cylinder Method |
| ASTM D 3017 | (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL

PROCEDURES:

SD-09 Reports

Field Density Tests; FIO. Testing of Backfill Materials; GA.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials include materials classified in ASTM D 2487 as CL, GW, GP, SW, GM, GC, and SM and shall be free of trash, debris, roots or other organic matter, or stones larger than 3 inches in any dimension.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, CH, MH, and ML and any other materials not defined as satisfactory.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than 2 percent by weight shall pass the No. 4 size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

Clearing and grubbing is specified in Section 02230 CLEARING AND GRUBBING. The areas within lines 5 feet outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of in the designated waste disposal areas.

3.2 TOPSOIL

Topsoil shall be stripped to a depth of 4-8 inches below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall include trenching for utility and foundation drainage systems to a point 5 feet beyond the building line of each building and structure, excavation for outside grease interceptors, underground fuel tanks, and all work incidental thereto. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

3.7 BLASTING

Blasting will be permitted with advance written approval from the Contracting Officer and G-3/DPTM Range Division.

3.8 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS.

3.9 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. For pile foundations, the excavation shall be stopped at an elevation of from 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, the remainder of the excavation shall be completed to the elevations shown. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking or other erosion resulting from ponding or flow of water.

3.10 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING and moisture content shall be within $\pm 2\%$ of optimum moisture.

3.11 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness, or 6 inches when hand-operated compactors are

used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

| | Percent Laboratory maximum density | |
|--|---------------------------------------|--------------------------|
| | Cohesive material | Cohesionless material |
| <u>Fill, embankment, and backfill</u> | | |
| Under structures, building slabs, steps, paved areas, around footings, and in trenches | 90 | 95 |
| Under sidewalks and grassed areas | 85 | 90 |
| Nonfrost susceptible materials | | 95 |
| <u>Subgrade</u> | | |
| Under building slabs, steps, and paved areas, top 12 inches | 90 | 95 |
| Under sidewalks, top 6 inches | 85 | 90 |

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomaction over underground utilities and heating lines shall be by hand tamping.

3.12 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922.

When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.12.1 In-Place Densities

3.12.1.1 In-Place Density of Subgrades

One test per 1,000 square foot or fraction thereof.

3.12.1.2 In-Place Density of Fills and Backfills

One test per 1,000 square foot or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 6 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 200 square feet, or one test for each 100 linear foot of long narrow fills 100 feet or more in length. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows: One check per lift for each 100 linear feet of long narrow fills.

3.12.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

3.12.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1,000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.13 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of four passes of a hand-operated plate-type vibratory compactor.

3.14 GRADING

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has

been accepted.

3.15 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 4 inches by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.16 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work shall be repaired and grades re-established to the required elevations and slopes.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02225

EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
 - 1.2.1 Satisfactory Materials
 - 1.2.2 Unsatisfactory Materials
 - 1.2.3 Cohesionless and Cohesive Materials
 - 1.2.4 Degree of Compaction
 - 1.2.5 Topsoil
- 1.3 SUBMITTALS
- 1.4 SUBSURFACE DATA
- 1.5 CLASSIFICATION OF EXCAVATION
 - 1.5.1 Rock Excavation
 - 1.5.2 Common Excavation
- 1.6 BLASTING
- 1.7 UTILIZATION OF EXCAVATED MATERIALS

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

- 3.1 STRIPPING OF TOPSOIL
- 3.2 EXCAVATION
 - 3.2.1 Ditches and Channel Changes
 - 3.2.2 Drainage Structures
- 3.3 SELECTION OF BORROW MATERIAL
- 3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS
- 3.5 BACKFILL
 - 3.5.1 Backfill at Retaining Walls and Structures
- 3.6 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS
- 3.7 EMBANKMENTS
 - 3.7.1 Earth Embankments
- 3.8 SUBGRADE PREPARATION
 - 3.8.1 Construction
 - 3.8.2 Compaction
 - 3.8.2.1 Subgrade for AMTC TRACKBEDS
 - 3.8.2.2 Subgrade for Base Courses
 - 3.8.2.3 Subgrade for Shoulders
- 3.9 FINISHING
- 3.10 PLACING TOPSOIL
- 3.11 TESTING
 - 3.11.1 Fill and Backfill Material Gradation
 - 3.11.2 In-Place Densities
 - 3.11.3 Check Tests on In-Place Densities
 - 3.11.4 Moisture Contents

- 3.11.5 Optimum Moisture and Laboratory Maximum Density
- 3.11.6 Tolerance Tests for Subgrades
- 3.12 SUBGRADE AND EMBANKMENT PROTECTION

-- End of Section Table of Contents --

SECTION 02225

EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM C 136 | (1995a) Sieve Analysis of Fine and Coarse Aggregates |
| ASTM D 422 | (1963; R 1990) Particle-Size Analysis of Soils |
| ASTM D 1140 | (1992) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve |
| ASTM D 1556 | (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.)) |
| ASTM D 2487 | (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 2922 | (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 3017 | (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 4318 | (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils |

KENTUCKY DEPARTMENT OF TRANSPORTATION

| | |
|-----------|---|
| KY DOT 98 | (1998) Standard Specifications for Road and Bridge Construction |
|-----------|---|

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by, ASTM D 2487 as GW, GP, SW, CL, GM, GC, SM, SP, SC, AND ML. Satisfactory materials for grading shall be free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 6 inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as MH, Pt, CH, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

1.2.4 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density.

1.2.5 Topsoil

Material suitable for topsoils obtained from excavations and areas indicated on the drawings is defined as a natural, workable, friable, loamy soil without admixture of subsoil, refuse, or foreign materials, weeds, brush, or other undesirable material, and suitable for growing grasses, legumes, or other vegetative ground cover.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Earthwork; FIO.

Procedure and location for disposal of unused satisfactory material. Blasting plan when blasting is permitted. Proposed source of borrow material.

SD-09 Reports

Testing; GA.

Within 24 hours of conclusion of physical tests, 6 copies of test results, including calibration curves and results of calibration tests.

SD-13 Certificates

Testing; GA.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

SD-18 Records

Earthwork; FIO.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings and in the Design Analysis. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at Law Engineering and Environmental Services, Inc. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation. In order to specify the utilization of the various excavated materials, they are differentiated below.

1.5.1 Rock Excavation

Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; and firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting. Subsurface soil boring logs indicate no anticipated rock excavation; however, variations may exist in the subsurface between boring locations. These and other typical drawings are provided for estimating purposes only. The Contractor shall make his own interpretation of the borings and the amount of rock or other material to be excavated.

1.5.2 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

1.6 BLASTING

Blasting shall be performed as necessary and approved. The Contractor shall submit a Blasting Plan and obtain written approval prior to performing any blasting. The plan shall contain provisions for storing, handling and transporting explosives as well as for the blasting operations. The Contractor shall be responsible for damage caused by blasting operations.

1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (NOT APPLICABLE).

PART 3 EXECUTION

Unless otherwise specified herein, earthwork construction shall be in accordance with paragraphs 204, 205, and 207 to 209 of KY DOT 98.

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 4-8 inches. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be stockpiled in locations indicated by the Contracting Officer.

3.2 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches and Channel Changes

Excavation of ditches and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 4 feet from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against

the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02720 STORM-DRAINAGE SYSTEM; and Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.5.1 Backfill at Retaining Walls and Structures

Backfill adjacent to structures and retaining walls shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure (i.e. scrapers, and vibratory rollers, etc.) in passing over and compacting these fills shall not be used. Heavy equipment will not be used in the first 6 to 8 feet from target retaining walls. Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

3.6 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 4-8 inches; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

3.7 EMBANKMENTS

3.7.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Shale shall be treated as earth fill; however, the maximum left thickness shall be 12 inches. The material shall be placed in successive horizontal layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials with a moisture content within $\pm 2\%$ of optimum. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE

PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.8 SUBGRADE PREPARATION

3.8.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 1/2-inch when tested with a 10 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.

3.8.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 90 percent of laboratory maximum density.

3.8.2.1 Subgrade for AMTC TRACKBEDS

Subgrade for AMTC Trackbeds shall be compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials.

3.8.2.2 Subgrade for Base Courses

Subgrade for base courses shall be compacted to at least 90 percentage laboratory maximum density for the depth below the surface of the pavement shown.

3.8.2.3 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 90 percentage laboratory maximum density for the depth below the surface of shoulder shown.

3.9 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be

finished to a smoothness suitable for the application of turfing materials.

3.10 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 4 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas.

3.11 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the government.

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. The first inspection be at the expense of the Government. Cost incurred for any subsequent inspections required because of failure of the first inspection will be charged to the Contractor. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017 ; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.11.1 Fill and Backfill Material Gradation

One test per 30,000 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136, ASTM D 422 or ASTM D 1140.

3.11.2 In-Place Densities

- a. One test per 5,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 500 square feet, or fraction thereof, of each lift of

fill or backfill areas compacted by hand-operated machines.

- c. One test per 500 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.
- d. One test per 500 linear feet, or fraction thereof, of each lift of embankment or backfill for AMTC Trackbed.

3.11.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each 20,000 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 2,000 square feet, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 2,000 linear feet, or fraction thereof, of embankment or backfill for roads.
- d. One check test per lift for each 2,000 linear feet, or fraction thereof, of embankment or backfill for AMTC Trackbeds.

3.11.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two (2) tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.11.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 30,000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.11.6 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.12 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

- 1.1 DEFINITIONS
 - 1.1.1 Clearing
 - 1.1.2 Grubbing
- 1.2 SUBMITTALS

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 CLEARING
- 3.2 GRUBBING
- 3.3 TREE AND BRUSH REMOVAL
- 3.4 DISPOSAL OF MATERIALS
 - 3.4.1 Salable Timber
 - 3.4.2 Materials Other Than Salable Timber

-- End of Section Table of Contents --

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared, as shown in the drawings and where grubbing is required by the specifications. Disposal by chipping and spreading is also acceptable.

1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-18 Records

Materials Other Than Salable Timber; GA.

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and

disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE AND BRUSH REMOVAL

In clearing areas where no excavation, filling or grading operations are required clearing shall consist of removing all trees to ground level and mowing the remainder of the vegetation with a suitable rotary cutter to a height of 3 inches. Non-vegetation areas shall be turfed by seeding and maintained in accordance with SECTION 02935 TURF. Low areas 20 feet each side of the edge of the creek bed or typical high water line whichever is greater shall be cleared of trees and maintained to a height of 3 feet. All revegetation along creek side shall be as indicated in SECTION 02935.

3.4 DISPOSAL OF MATERIALS

3.4.1 Salable Timber

All felled timber from which saw logs, pulpwood, posts, poles, ties, mine props, or cordwood can be produced shall be considered as salable timber, and shall become the property of the contractor. Contractor shall be aware that trees may contain metal fragments.

3.4.2 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of in the designated waste disposal area as directed by the Contracting Officer or by burning when approved in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed. Refuse to be burned shall be burned at specified locations and in a manner to prevent damage to existing structures and appurtenances, construction in progress, trees, and other vegetation. The Contractor shall be responsible for compliance with all Federal and State laws and regulations and with reasonable practice relative to the building of fires. Burning or other disposal of refuse and debris and any accidental loss or damage attendant thereto shall be the Contractor's responsibility.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02233

GRADED-CRUSHED-AGGREGATE BASE COURSE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DEGREE OF COMPACTION
- 1.4 EQUIPMENT
 - 1.4.1 Approval
 - 1.4.2 Weather Limitation
- 1.5 SAMPLING AND TESTING
 - 1.5.1 Samples
 - 1.5.2 Tests
 - 1.5.2.1 Sieve Analyses
 - 1.5.2.2 Liquid Limit and Plasticity Index
 - 1.5.2.3 Density Tests
 - 1.5.2.4 Soundness Test
 - 1.5.2.5 Wear Test
 - 1.5.3 Approval of Material

PART 2 PRODUCTS

- 2.1 AGGREGATES
 - 2.1.1 Coarse Aggregates
 - 2.1.2 Fine Aggregate
 - 2.1.3 Gradation Requirements
 - 2.1.4 Liquid Limit and Plasticity Index

PART 3 EXECUTION

- 3.1 OPERATION OF AGGREGATE SOURCES
- 3.2 STOCKPILING MATERIAL
- 3.3 PREPARATION OF UNDERLYING COURSE
- 3.4 GRADE CONTROL
- 3.5 MIXING OF MATERIALS
- 3.6 PLACING
- 3.7 COMPACTION
 - 3.7.1 Requirements
 - 3.7.2 Finishing
- 3.8 SMOOTHNESS TEST
- 3.9 THICKNESS CONTROL
- 3.10 MAINTENANCE

-- End of Section Table of Contents --

SECTION 02233

GRADED-CRUSHED-AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM C 29 | (1991a) Unit Weight and Voids in Aggregate |
| ASTM C 88 | (1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate |
| ASTM C 117 | (1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing |
| ASTM C 131 | (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C 136 | (1995a) Sieve Analysis of Fine and Coarse Aggregates |
| ASTM D 75 | (1987; R 1992) Sampling Aggregates |
| ASTM D 1556 | (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.)) |
| ASTM D 2487 | (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 2922 | (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 3017 | (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 4318 | (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| ASTM E 11 | (1995) Wire-Cloth Sieves for Testing |

Purposes

ASTM E 548

(1994) General Criteria Used for
Evaluating Laboratory Competence

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Sampling and testing; GA.

Copies of field test results.

1.3 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557. This will be abbreviated herein after as percentage of laboratory maximum density.

1.4 EQUIPMENT

1.4.1 Approval

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.4.2 Weather Limitation

Base courses shall be placed when the atmospheric temperature is above 35 degrees F. Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirement.

1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection will be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. The materials shall be tested to establish compliance with the specified requirements. Copies of test results shall be furnished to the Contracting Officer.

1.5.1 Samples

Samples for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.5.2.1 Sieve Analyses

Sieve analyses shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11. Sieve analysis shall be performed as a minimum on each 3,000 tons placed at the job site.

1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.5.2.3 Density Tests

Density tests shall be performed for each 300 L.F. of roadway per lift of material placed.

Density shall be measured in the field in accordance with ASTM D 1556 or ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration of the ASTM publication. Tests performed in accordance with ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.

1.5.2.4 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

1.5.2.5 Wear Test

Wear tests shall be made in conformance with ASTM C 131.

1.5.3 Approval of Material

The source of the material to be used for producing aggregates shall be selected 60 days prior to the time the material will be required in the work. Tentative approval of the source will be based on an inspection by the Contracting Officer. Tentative approval of material will be based on tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation, liquid limit, and

plasticity index performed on samples taken from the completed and compacted subbase course.

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of crushed stone, crushed slag, or crushed gravel, and screenings. The Contractor shall obtain materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein, after all compaction and proof-rolling operations have been completed. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 65 pcf as determined by ASTM C 29. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregates

Coarse aggregates shall be angular particles of uniform density. The coarse aggregate shall have a loss not greater than 15 percent weighted averaged at five cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The coarse aggregate shall have a percentage of wear not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 1/2 inch sieve and in the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

2.1.2 Fine Aggregate

Fine aggregate shall be angular particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. Fine aggregate shall be produced by crushing only particles larger than No. 4 sieve in size. The fine aggregate shall contain at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the No. 4 sieve and retained on the No. 10 sieve, and in the portion passing the No. 10 sieve and retained on the No. 40 sieve.

2.1.3 Gradation Requirements

Gradation requirements specified herein shall apply to the completed base course. The aggregates shall have a maximum size as shown and be graded continuously well within the limits specified in TABLE I. Sieves shall conform to ASTM E 11.

TABLE 1 - GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

| Sieve Designation | KYDOT #3 | KYDOT #357 | KYDOT #57 | KYDOT #610 |
|----------------------|-------------|---------------|--------------|---------------|
|----------------------|-------------|---------------|--------------|---------------|

Percentage by Weight Passing Square-Mesh Sieve

| Sieve Designation | KYDOT #3 | KYDOT #357 | KYDOT #57 | KYDOT #610 |
|-------------------|----------|------------|-----------|------------|
| 63 mm | 100 | 100 | --- | --- |
| 50 mm | 90-100 | 95-100 | --- | --- |
| 37.5 mm | 35-70 | --- | 100 | 100 |
| 25 mm | 0-15 | 35-70 | 95-100 | 85-100 |
| 12.5 mm | 0-5 | 10-30 | 25-10 | 40-75 |
| 4.75 mm | --- | 0-5 | 0-10 | 15-40 |
| 2.36 mm | --- | --- | 0-5 | --- |

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated in such a manner as to produce the quantity and quality of base course materials meeting these specification requirements in the specified time limits. Upon completion of the work, the aggregate sources on Government reservations shall be conditioned to drain readily and be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the crushed-aggregate base course, the underlying course shall be cleaned of all foreign substances. At the time of construction

| | | | | |
|---------|--------|--------|--------|--------|
| 63 mm | 100 | 100 | --- | --- |
| 50 mm | 90-100 | 95-100 | --- | --- |
| 37.5 mm | 35-70 | --- | 100 | 100 |
| 25 mm | 0-15 | 35-70 | 95-100 | 85-100 |
| 12.5 mm | 0-5 | 10-30 | 25-10 | 40-75 |
| 4.75 mm | --- | 0-5 | 0-10 | 15-40 |
| 2.36 mm | --- | --- | 0-5 | --- |

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the No. 40 sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated in such a manner as to produce the quantity and quality of base course materials meeting these specification requirements in the specified time limits. Upon completion of the work, the aggregate sources on Government reservations shall be conditioned to drain readily and be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the crushed-aggregate base course, the underlying course shall be cleaned of all foreign substances. At the time of construction of the base course, the underlying course shall contain no frozen material. The underlying course shall conform to Section 02225 EARTHWORK FOR ROADWAYS TRAILS, TARGETS AND BERMS. Ruts or soft, yielding

spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

3.4 GRADE CONTROL

During construction, the lines and grades including crown and cross slope indicated for the base course shall be maintained by means of line and grade stakes placed by the Contractor.

3.5 MIXING OF MATERIALS

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make such adjustments in mixing procedures or in equipment as may be directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to ensure a satisfactory base course meeting all requirements of this specification.

3.6 PLACING

The mixed aggregate material shall be placed on the prepared subgrade or subbase in uniform layers. When a compacted layer 6 inches or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 6 inches is required, the material shall be placed in layers of equal thickness. No layer shall exceed 6 inches or be less than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to ensure an acceptable base course.

3.7 COMPACTION

3.7.1 Requirements

Each layer of base course including shoulders shall be compacted as specified to produce an average field-measured density, through the full depth, of at least 100 percent of laboratory maximum density obtained in the laboratory. Exception: Base layers of #3 and #357 shall be compacted by 4 to 6 passes with a 10 ton vibratory roller, as directed by the Contracting Officer, no density test required. Water content shall be maintained during the compaction procedure and subsequent proof rolling of designated areas such that the water content is within plus or minus 2 percent of optimum water content as determined from laboratory tests as specified in density test procedures listed in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the base course material shall be compacted with mechanical tampers.

3.7.2 Finishing

The surface of top layer of base course shall be finished after final compaction, and proof rolled, where required, by cutting any overbuild to grade and rolling with a steel-wheeled roller. In no case will thin layers of material be added to the top layer of base course to meet grade. If the elevation of top layer of base course is 1/2 inch or more below the grade, the top layer of base shall be scarified to a depth of at least 3 inches, new material shall be added, and the layer shall be blended and recompact to bring to grade. Adjustments in rolling and finishing procedures shall be made as may be directed to obtain grades, to minimize segregation and degradation of base course material, to adjust the water content, and to insure an acceptable base course. Material found unacceptable shall be removed and replaced, as directed, with acceptable material.

3.8 SMOOTHNESS TEST

The surface of the top layer shall not deviate more than 1/2-inch when tested with a 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 1/2-inch shall be corrected as directed.

3.9 THICKNESS CONTROL

The completed thickness of the base course shall be within 1/2-inch for 6 to 12 inch layers and 3/8-inch for 4 inch layers. The thickness of the base course shall be measured at intervals providing at least one measurement for at least each 500 square yards of base course. The depth measurement shall be made by test holes at least 3 inches in diameter. Where the measured thickness of the base course is more than 1/2 inch deficient for 6 to 12 inch layers and 3/8-inch deficient for 4 inch layers, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 1/2-inch more than indicated, it will be considered as conforming with the requirements plus 1/2 inch, provided the surface of the base course is within 1/2 inch of established grade. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness indicated.

3.10 MAINTENANCE

The base course shall be maintained in a condition that will meet all specification requirements until accepted.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02275

FILTER FABRIC

PART 1 GENERAL

- 1.1 SUMMARY (Not Applicable)
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING OF FILTER FABRIC MATERIALS
 - 1.4.1 Delivery and Storage
 - 1.4.2 Handling

PART 2 PRODUCTS

- 2.1 FILTER FABRIC

PART 3 EXECUTION

- 3.1 INSTALLATION OF FILTER FABRIC

-- End of Section Table of Contents --

SECTION 02275

FILTER FABRIC

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM D 751 | (1979) Coated Fabrics |
| ASTM D 1117 | (1980) Nonwoven Fabrics |
| ASTM D 1682 | (R 1975) Breaking Load and Elongation of Textile Fabrics |

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTALS:

SD-13 Certificates

Certification of Compliance; FIO.

Prior to installation certificates required for demonstrating proof of compliance of filter fabric material to be used, shall be submitted to the Contracting Officer. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the contract, the project name and location, and the quantity and the date or dates of shipment or delivery to which the certificates apply. The certification shall attest that the filter fabric meets the chemical, physical, and manufacturing requirements stated in this specification. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing adequate material, if after the tests are performed on selected samples, the material is found not to meet this specification.

1.4 DELIVERY, STORAGE, AND HANDLING OF FILTER FABRIC MATERIALS

1.4.1 Delivery and Storage

Fabric delivered to the site shall be inspected for damage, unloaded, and stored with a minimum of handling. Fabric shall not be stored directly on

the ground. During shipment and storage, fabric shall be wrapped in a heavy-duty protective covering. The storage area shall be such that the fabric is protected from temperatures greater than 140 degrees F., mud, soil, dust, and debris.

1.4.2 Handling

Filter fabric shall be handled in such a manner as to ensure delivery to area for placement in sound, undamaged condition.

PART 2 PRODUCTS

2.1 FILTER FABRIC

Filter fabric shall be a pervious sheet of nonwoven polypropylene or polyester with continuous filaments formed into a uniform pattern with distinct and measureable openings. The filter fabric shall provide an Equivalent Opening Size (EOS) no finer than the U. S. Standard Sieve No. 100 and no coarser than the U. S. Standard Sieve No. 70. EOS is defined as the number of the U. S. Standard Sieve having opening closest in size to the fabric openings. The fabric shall conform to the physical strength requirements in Table 1. The edges of the fabric shall be selvaged or otherwise finished to prevent the outer material from pulling away from the fabric. The minimum width of the filter fabric delivered to the project site shall be such that it can be placed as shown without seams.

TABLE 1 - PHYSICAL STRENGTH REQUIREMENTS

| <u>Physical Property</u> | <u>Test Procedure (b)</u> | <u>Acceptable Test Results</u> |
|---|--|---|
| Tensile Strength (unaged fabric) (a) | ASTM D 1682, Grab Test Method using a 1 inch square jaws and a travel rate of 12 inches per minute | 125 pounds per inch minimum in any principle direction) |
| Punctured Strength (unaged fabric) (a) | ASTM D 751, Tension Testing Machine with Ring Clamp; steel ball replaced with a 5/16-inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp | 100 (pounds minimum) |
| Abrasion Resistance | ASTM D 1682, as above, after abraded, as in ASTM D 4157 and ASTM D 4158, Rotary Platform Double Head Method; rubber-base abrasive wheel equal to CS-17 "Calibrase" by Taber Instrument Company; 1 kilogram load per wheel; 1,000 revolutions | 66 (pounds minimum in any principle direction) |

(a) Unaged fabric is defined as fabric in the condition received from the manufacturer or distributor.

| <u>Physical Property</u> | <u>Test Procedure (b)</u> | <u>Acceptable Test Results</u> |
|--------------------------|--|--------------------------------|
| (b) | Nonwoven fabric test procedures shall be modified as specified in ASTM D 1117. | |

PART 3 EXECUTION

3.1 INSTALLATION OF FILTER FABRIC

The filter fabric shall be placed as recommended by the manufacturer and as shown. At the time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration, or damaged incurred during manufacturing, transportation, or storage. The fabric shall be placed with the long dimension parallel to the prepared foundation and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric at no additional costs to the government. Any machinery used in the placement and compaction of gravel filler material shall be of such design that they will not damage the underlying filter fabric. Any fabric damaged during its installation shall be replaced by the contractor at no cost to the government. Work shall be scheduled so that the covering of the fabric with a layer of the fill material is accomplished immediately after placement of the fabric. Before the placement of materials over the fabric, the contractor shall demonstrate to the Contracting Officer that the placement technique will prevent damage to the fabric.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEGREE OF COMPACTION
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Satisfactory Materials
 - 2.1.2 Unsatisfactory Materials
 - 2.1.3 Cohesionless and Cohesive Materials
 - 2.1.4 Rock
 - 2.1.5 Unyielding Material
 - 2.1.6 Unstable Material
 - 2.1.7 Select Granular Material
 - 2.1.8 Initial Backfill Material
- 2.2 PLASTIC MARKING TAPE

PART 3 EXECUTION

- 3.1 EXCAVATION
 - 3.1.1 Trench Excavation
 - 3.1.1.1 Bottom Preparation
 - 3.1.1.2 Removal of Unyielding Material
 - 3.1.1.3 Removal of Unstable Material
 - 3.1.1.4 Excavation for Appurtenances
 - 3.1.1.5 Jacking, Boring, and Tunneling
 - 3.1.2 Stockpiles
- 3.2 BACKFILLING AND COMPACTION
 - 3.2.1 Trench Backfill
 - 3.2.1.1 Replacement of Unyielding Material
 - 3.2.1.2 Replacement of Unstable Material
 - 3.2.1.3 Bedding and Initial Backfill
 - 3.2.1.4 Final Backfill
 - 3.2.2 Backfill for Appurtenances
- 3.3 SPECIAL REQUIREMENTS
 - 3.3.1 Electrical Distribution System
 - 3.3.2 Plastic Marking Tape
- 3.4 TESTING
 - 3.4.1 Testing Facilities
 - 3.4.2 Testing of Backfill Materials
 - 3.4.3 Field Density Tests
 - 3.4.4 Displacement of Sewers

-- End of Section Table of Contents --

SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM D 422 | (1963; R 1990) Particle-Size Analysis of Soils |
| ASTM D 1556 | (1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.)) |
| ASTM D 2167 | (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| ASTM D 2487 | (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 2922 | (1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 3017 | (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |

1.2 DEGREE OF COMPACTION

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Field Density Tests; FIO. Testing of Backfill Materials; GA.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall consist of any material classified by ASTM D 2487 as ML, CL, GM, GC, CH, SC, SP, SM, GW, GP, and SW.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include, but are not limited to, those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 2 inches, and materials classified in ASTM D 2487, as MH, PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials shall include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

2.1.4 Rock

Rock shall consist of boulders measuring 1/2 cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic yard in volume, except that pavements shall not be considered as rock.

2.1.5 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 2 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.6 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.7 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 1 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.8 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 1 inch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

| | |
|---------|--|
| Red: | Electric |
| Yellow: | Gas, Oil, Dangerous Materials |
| Orange: | Telephone, Telegraph, Television, Police, and Fire Communications |
| Blue: | Water Systems |
| Green: | Sewer Systems |

PART 3 EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site or shall be disposed of by spreading on the site as directed by the Contracting Officer. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 5 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be

exposed to moving ground or cave in. Vertical trench walls more than 5 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1 inch or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed 18 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.2 Stockpiles

Stockpiles of satisfactory materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown after all specified tests are performed.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

3.2.1.3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, trails, targets, and berms, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

- a. Roadways, Trails, Targets, and Berms: Backfill shall be placed up to the elevation at which the requirements in Section 02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS control. Water

flooding or jetting methods of compaction will not be permitted.

- b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas:
Backfill shall be deposited in layers of a maximum of 12 inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Backfill for Appurtenances

After the manhole, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.3.2 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.4.2 Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 1,000 feet of installation shall be performed under construction areas. A minimum of one field density test per lift of backfill for every 2,000 feet of installation shall be performed under non-construction areas. One moisture density relationship shall be determined for every meters 1500 cubic yards of material used. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02360

STEEL H-PILES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 EXPERIENCE
- 1.4 SUBSURFACE DATA

PART 2 PRODUCTS

- 2.1 MATERIALS
- 2.2 EQUIPMENT
 - 2.2.1 Pile Hammers
 - 2.2.2 Driving Helmets and Pile Cushions

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Pile Driving
 - 3.1.2 Pre-Drilling
 - 3.1.3 Jetting of Piles
 - 3.1.4 Long Piles
 - 3.1.5 Splices
 - 3.1.6 Welding
 - 3.1.7 Tolerances in Driving
 - 3.1.8 Cutting of Piles

-- End of Section Table of Contents --

SECTION 02360

STEEL H-PILES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1994) Carbon Structural Steel

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1994) Structural Welding Code - Steel

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; GA.

Descriptions of all pile driving equipment to be employed in the work, prior to commencement of pile installations, including details of the pile hammer, power plant, leads, cushion material, and helmet.

SD-13 Certificates

Materials; GA.

Certified copies of mill test reports for structural steel prior to commencement of pile installations.

SD-18 Records

Pile Driving; FIO.

A complete and accurate record of each driven pile, within 3 days of completion of driving. The record shall indicate the pile location (as driven), size, driven length, embedded length, final elevations of tip and top, pile weight, number of splices and locations, blows required for each foot of penetration throughout the entire length of the pile and for the final 6 inches of penetration, and the total driving time. The record shall also include the type and size of the hammer used, the rate of operation, and the type and dimensions of driving helmet and cushion block

used. Any unusual conditions encountered during pile installation shall be recorded and immediately reported to the Contracting Officer.

1.3 EXPERIENCE

The work shall be performed by a general contractor or a specialty subcontractor specializing in the specified foundation system and having experience installing the specified foundation system under similar subsurface conditions.

1.4 SUBSURFACE DATA

Subsurface soil data logs are shown on the drawings.

PART 2 PRODUCTS

2.1 MATERIALS

Piles shall be of sections, sizes, materials, and weights indicated. Pile tips as driven shall be square and blunt as received from the mill. Pile tip reinforcements or cast steel points occasionally may be required to obtain the required penetration. Steel shall conform to ASTM A 36.

2.2 EQUIPMENT

2.2.1 Pile Hammers

The hammer used shall have a delivered energy suitable for the total weight of the pile, the character of subsurface material to be encountered, and the pile capacity to be developed. The driving energy of the hammer shall be not less than 15,000 foot-pounds.

2.2.2 Driving Helmets and Pile Cushions

A driving helmet or cap including a pile cushion shall be used between the top of the pile and the ram to prevent impact damage to the pile. The driving helmet or cap and pile cushion combination shall be capable of protecting the head of the pile, minimizing energy absorption and dissipation, and transmitting hammer energy uniformly over the top of the pile. The driving helmet or cap shall fit loosely around the top of the pile so that the pile is not restrained by the driving cap if the pile tends to rotate during driving. The pile cushion may be made of solid wood or of laminated construction using plywood, softwood, or hardwood boards or other cushion material as approved by the Contracting Officer. The pile cushion shall completely cover the top surface of the pile and shall be retained by the driving helmet. The minimum thickness of the pile cushion shall be 3 inches and the thickness shall be increased so as to be suitable for the size and length of pile, character of subsurface material encountered, hammer characteristics, and required driving resistance.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pile Driving

No piling shall be driven within 100 feet of concrete which has been in place less than the minimum curing time indicated in KY DOT 98, paragraph 601.03.14 unless otherwise authorized by the Contracting Officer. A

complete and accurate record of the driving of piles shall be compiled by the contractor for submission to the Contracting Officer. This record shall include pile dimensions and location, the description of hammer used, rate of hammer operation, number of blows required for each foot of penetration throughout the entire length of each pile and any other pertinent information requested by the Contracting Officer. When driving long piles of high slenderness-ratio, special precautions shall be taken to insure against overstressing and leading away from a plumb or true position. During driving, pile driving hammers shall be operated at all times at the speed and conditions recommended by the hammer manufacturer. Each pile shall be driven continuously and without interruption to refusal on rock. Deviation from this procedure will be permitted only in case the driving is stopped by causes which reasonably could not have been anticipated. A pile which has not reached refusal when the top has been driven to the cut off elevation, shall be spliced by welding as indicated.

Welding shall be according to AWS D1.1. Certification of welders shall be submitted for information purposes only. Jetting shall not be used to assist during the piles. A pile shall be considered driven to refusal when forty (40) blows of the hammer produce a total penetration of one inch or less or as directed or as directed by the Contracting Officer. Driving should then cease, provided that the pile has not hit an obstruction, and has been driven to the depth at which the borings indicate rock. A pile which cannot be driven to the required depth because of an obstruction shall be pulled and redriven or shall be cut off and abandoned, whichever is directed by the Contracting Officer. Predrilling, as approved by the Contracting Officer, will be allowed if extreme difficulty is encountered in driving the piles to rock. When driving piles in clusters, or under conditions of relatively close spacing, observations shall be made to determine uplift. Uplifted piles shall be backdriven to refusal without additional cost of the government. Piles which are damaged as a result of driving shall be withdrawn and replaced by new piles or shall be cut off and abandoned and additional piles driven, as directed by the Contracting Officer and without additional cost to the government. The Contracting Officer may require that any pile be withdrawn for inspection. Piles withdrawn at the request of the Contracting Officer and found to be in suitable condition shall be redriven at the government's expense and those found not suitable shall be replaced by new piles at the contractor's expense.

3.1.2 Pre-Drilling

Pre-drilling of piles will not be permitted.

3.1.3 Jetting of Piles

Jetting of piles will not be permitted.

3.1.4 Long Piles

Pile lengths of 40 feet or more shall be handled and driven carefully to prevent overstress or leaning from a true position. The pile-driving rig shall have sufficiently rigid supports so that the leads remain accurately aligned. Templates or guide frames shall be erected at or close to the ground or water surface.

3.1.5 Splices

Field splices should be avoided for lengths under 60 feet. When authorized

by the Contracting Officer, splices shall be of the full penetration butt-weld type. Unless otherwise authorized by the Contracting Officer, only one splice shall be permitted per length of pile. Splices shall be designed and constructed to maintain the true alignment and position of the pile sections. Splices shall develop the full strength of the pile in both bearing and bending. Proprietary prefabricated splicer sleeves may be used upon prior approval by the Contracting Officer.

3.1.6 Welding

Shop and field welding, qualification of welding procedures, welders, and welding operators shall be in accordance with AWS D1.1.

3.1.7 Tolerances in Driving

Top of pile at elevation of cut off shall be within 2 inches of the location indicated. Additionally, a variation in batter, as measured on the driven pile, of not more than 1/4 inch per foot of longitudinal axis will be permitted. Manipulation of piles to force them into position will not be permitted. Piles will be checked for heave. Piles found to have heaved shall be redriven to the required point elevation. Piles damaged or driven outside the above tolerances shall be replaced or additional piles driven at locations specified by the Contracting Officer at no expense to the Government.

3.1.8 Cutting of Piles

Piles shall be cut off at the elevations indicated by a method approved by the Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02450

TIMBER TIES, BALLAST, AND GEOGRID

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - 1.3.1 Materials and Samples
 - 1.3.2 Geogrid
- 1.4 QUALIFICATIONS
 - 1.4.1 Construction Supervision

PART 2 PRODUCTS

- 2.1 BALLAST
- 2.2 GEOGRID
- 2.3 WOOD CROSSTIES

PART 3 EXECUTION

- 3.1 TRACK CONSTRUCTION
 - 3.1.1 Roadbed Preparation
 - 3.1.2 Geogrid
 - 3.1.3 Unloading the Materials
 - 3.1.4 Ballast Distribution
 - 3.1.5 Cleanup
 - 3.1.6 Subgrade
- 3.2 CROSSTIES
- 3.3 SAMPLING AND TESTING
 - 3.3.1 Ballast Samples
 - 3.3.2 Ballast Tests
 - 3.3.2.1 Sieve Analysis
 - 3.3.2.2 Bulk Specific Gravity and Absorption
 - 3.3.2.3 Percentage of Clay Lumps and Friable Particles
 - 3.3.2.4 Degradation Resistance
 - 3.3.2.5 Soundness Test
 - 3.3.2.6 Percentage of Flat or Elongated Particles
 - 3.3.3 Tie Testing
- 3.4 INSPECTION AND FIELD TESTING

-- End of Section Table of Contents --

SECTION 02450

TIMBER TIES, BALLAST, AND GEOGRID

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA MRE (1995) Manual for Railway Engineering
(Fixed Properties)

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA M2 (1995) Standard for Inspection of Treated
Timber Products

KENTUCKY DEPARTMENT OF TRANSPORTATION

KY DOT 98 (1998) Standard Specifications for Road
and Bridge Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Materials and Equipment; GA.

A complete schedule of the materials proposed for installation within 60 days of receipt of notice to proceed, and before installation of the materials; the schedule shall include a list of equipment proposed for the work.

SD-09 Reports

Sampling and Testing; GA.

One certified copy of Test Reports for each test performed on the ballast within 2 working days of the test completion.

Examination of Geogrid; GA.

Independent testing laboratory's certified test reports for geotextiles, including necessary analysis and interpretation. These reports shall

provide results of the laboratory testing performed on samples of the geotextile material delivered to the jobsite. Test reports shall be submitted at least 5 working days prior to the installation of the geotextile.

SD-13 Certificates

Materials; FIO.

The contractor shall submit weight tickets for the amount of ballast to be stockpiled at AMTC and maximum density of the proposed stone to be used.

Wood Ties; GA.

Certified test and inspection reports for cross ties and switch ties subsequent to treatment and a minimum of seven calendar days prior to any ties being installed in track. Test and inspection reports shall contain the information required by Part 7 of AWPB M2.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Materials and Samples

The Contracting Officer will notify the Contractor of the materials approved or disapproved. Disapproved materials that have already been delivered to the project site, shall be promptly segregated from the approved materials and removed from the premises. If materials are disapproved, acceptable replacement materials shall be provided at no additional cost to the Government. Initial approval by the Contracting Officer will not prevent the removal and replacement of materials that are materially defective or materials not meeting this specification that are discovered during construction and/or routine quality control/quality assurance operations.

1.3.2 Geogrid

Geogrids shall be shipped and stored in its original ultraviolet resistant cover until the day of installation. Geogrid shall be stored in such a manner as to be protected from vandalism, temperatures greater than 140 degrees F, dirt, dust, mud, debris, moisture, sunlight, and ultraviolet rays. Geogrid delivered to the project site shall be clearly labeled on the material cover to show the manufacturer's name, brand name, fabric type, location and date manufactured, lot identification, width, and length.

1.4 QUALIFICATIONS

1.4.1 Construction Supervision

All construction shall be performed under the direction of qualified and competent supervisory personnel experienced in similar construction.

PART 2 PRODUCTS

2.1 BALLAST

Prepared ballast shall be crushed stone or crushed air-cooled blast-furnace slag, Size No. 57 conforming to Chapter 1, Part 2, of AREA MRE for quality, soundness and gradation or conforming to KY DOT 98 #57.

2.2 GEOGRID

Geogrid shall be a continuous sheet of polypropylene punched and biaxially drawn to increase mechanical properties. The aperture geometry and rib and junction cross sections shall permit significant mechanical interlock with the material being reinforced. The geogrid shall have a high continuity of strength through all ribs and junctions of the grid structure. The material shall be UV resistant and be resistant to biological or chemical degradation normally encountered. The minimum width of the geogrid roll delivered to the site shall be such that it can be placed as shown without seams.

Physical Properties

Aperture Sizer

| | | |
|-----|-----------|-------|
| MD | Calipered | 25 mm |
| CMD | Calipered | 33 mm |

Thickness

| | | |
|-----------|----------------|--------|
| Ribs | ASTM D 1777-64 | .5 mm |
| Junctions | | 2.0 mm |

Wide Width Strip
Tensile Strength

| | |
|-----------|----------|
| 2% Strain | 240 kg/m |
| 5% Strain | 550 kg/m |
| Ultimate | 865 kg/m |

Materials

| | | |
|---------------|---|-----------|
| Polypropylene | ASTM D 4104 Group 1/Class 1 Grade 2 | 98% min. |
| Carbon Black | ASTM 4218 | 0.5% min. |

2.3 WOOD CROSSTIES

Wood cross ties shall conform to Chapter 3, Part 1 of AREA-01. Species shall be Red and White Oak, Southern Pine or Douglas Firs. Ties shall be treated in accordance with AWPA C6. Treated ties shall be permanently marked or branded by the producer in accordance with AWPA M6. All ties except Southern Pine shall be incised prior to treatment. Splits shall not be longer than 4 inches and not wider than 1/4 inch at either end. Splits longer than 4 inches but not longer than the width of the face in which the split appears shall be acceptable if anti-splitting devices are installed with the splits compressed. S-irons, dowels, and end plates are acceptable anti-splitting devices. When inspections result in product rejection, the Contractor shall promptly segregate and remove rejected material from the premises. The government may also charge the contractor any additional cost of inspection or test when prior rejection makes reinspection or retesting necessary.

Wood ties used in this project shall be sawed, and shall not be less than 7 inches thick and 9 inches wide. The length shall be as required in the drawings.

PART 3 EXECUTION

3.1 TRACK CONSTRUCTION

3.1.1 Roadbed Preparation

Clearing and grubbing, grading, excavation, embankment preparation, and subgrade preparation shall be performed in accordance with Sections 02110 CLEARING AND GRUBBING and 02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS. Trackbed surface, grade, and drainage shall be approved prior to placing ballast. Where the subgrade or roadbed is damaged during distribution of materials, ruts and depressions shall be filled and compacted and the trackbed surface reapproved prior to track construction.

3.1.2 Geogrid

Geogrid conforming to the requirements of this section shall be placed between the subgrade and the ballast as indicated on the project plans. Geogrid shall be installed in accordance with manufacturer's instructions and the following procedures. Pin the grid to the ground with 6" "U" staples. Roll out geogrid and tighten by hand to pick up all slack.

3.1.3 Unloading the Materials

The use of picks in the handling of ties will not be permitted.

3.1.4 Ballast Distribution

The contractor shall furnish and install 65 feet of ballast on the storage building end of the AMTC as shown in the plans and 4 inches of ballast for the remainder of the track subgrade. This quantity is separate from the ballast to be stockpiled. The contractor shall make arrangements to furnish and stockpile new ballast at each end of the track when and as directed. The stockpiled ballast shall remain at the vendors yard. All costs of material and delivery to the AMTC sites shall be the responsibility of the contractor. The total amount of stone stockpiled shall be equal to 420 compacted cubic yards for each AMTC.

Ballast shall not be placed until the area where it is to be used has been approved by the Inspector. Care shall be taken when distributing ballast from automotive equipment to prevent forming of ruts that would impair proper roadway drainage. Any ruts formed that would impair drainage shall be leveled and graded to drain. Excess ballast shall be picked up and redistributed at the Contractor's expense.

3.1.5 Cleanup

Upon completion of the work the contractor shall remove all rubbish, waste, and discarded materials generated by the work from the project area.

3.1.6 Subgrade

The subgrade shall be bladed to a level surface and compacted to at least 90 percent ASTM D 1557 maximum dry density for cohesive materials or 95 percent ASTM D 1557 maximum dry density for cohesionless materials.

3.2 CROSSTIES

Cross ties shall be placed in the manner and locations indicated in the plans. Cross ties to be stacked vertically or horizontally as indicated and shall be selected to obtain minimum gaps and provide level surface. Adzing shall be limited to small areas required to obtain a tight fit. Where ties are cut, the damaged surface shall be completely saturated with preserving solution. Cross ties shall be moved and set in place with slings or other approved mechanical means. The use of surface damaging tools will not be permitted;

NOTE: No cross ties will be used under tract (trackage by others).

3.3 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor, subject to approval. If the Contractor elects to establish testing facilities on his own, approval of such facilities shall be based on compliance with ASTM D 3740. No work requiring testing will be permitted until the contractor's facilities have been inspected and approved. The first inspection of the facilities shall be at the expense of the government and any subsequent inspections required because of failure of the first inspection will be at the expense of the contractor. Such costs will be deducted from the total amount due the Contractor.

3.3.1 Ballast Samples

Samples of ballast materials for material gradation, quality, and soundness tests shall be taken in conformance with ASTM D 75. Test samples shall be reduced from field samples in conformance with ASTM C 702.

3.3.2 Ballast Tests

3.3.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

3.3.2.2 Bulk Specific Gravity and Absorption

Bulk specific gravity and absorption tests shall be made in conformance with ASTM C 127.

3.3.2.3 Percentage of Clay Lumps and Friable Particles

The percentage of clay lumps and friable particles shall be determined in conformance with ASTM C 142.

3.3.2.4 Degradation Resistance

Resistance to degradation of materials shall be determined in conformance with ASTM C 131 and ASTM C 535. Materials with gradations having 100 percent passing the 1 inch sieve shall be tested in conformance with ASTM C 131. Materials having gradations with particles larger than 1 inch shall be tested in conformance with ASTM C 535.

3.3.2.5 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

3.3.2.6 Percentage of Flat or Elongated Particles

The percentage of flat or elongated particles shall be determined in conformance with test method COE CRD-C 119.

3.3.3 Tie Testing

The contractor shall be responsible for the quality of the treated ties. Each tie shall be permanently marked or branded by the producer in accordance with AWPA M6. Treated wood shall be inspected, in accordance with AWPA M2, for conformance with the specified AWPA standards. Inspection shall be performed by an independent inspection agency approved by the Contracting Officer. The agency's report of inspection shall accompany delivery of the ties, and shall be provided to the Contracting Officer.

3.4 INSPECTION AND FIELD TESTING

Quality control inspection and testing shall be performed by the contractor.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02660

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 PIPING
 - 1.2.1 Service Lines
 - 1.2.2 Distribution Lines 3 Inches or Larger
 - 1.2.3 Plastic Pipe
 - 1.2.4 Excavation, Trenching, and Backfilling
- 1.3 SUBMITTALS
- 1.4 HANDLING
 - 1.4.1 Polyethylene (PE) Pipe
 - 1.4.2 Miscellaneous Plastic Pipe and Fittings

PART 2 PRODUCTS

- 2.1 PIPE
 - 2.1.1 Plastic Pipe
 - 2.1.1.1 Polyethylene Plastic (PE)
 - 2.1.1.2 Polyvinyl Chloride (PVC) Plastic Pipe
 - 2.1.2 Ductile-Iron Pipe
 - 2.1.3 Copper Tubing
- 2.2 FITTINGS AND SPECIALS
 - 2.2.1 Polyvinyl Chloride (PVC) Pipe
 - 2.2.2 Ductile-Iron Pipe
 - 2.2.3 Dielectric Fittings
 - 2.2.4 Copper Tubing
- 2.3 JOINTS
 - 2.3.1 Plastic Pipe
 - 2.3.1.1 Polyethylene (PE) Pipe
 - 2.3.1.2 Polyvinyl Chloride Pipe
 - 2.3.2 Ductile-Iron Pipe
 - 2.3.3 Isolation Joints
 - 2.3.4 Copper Tubing
- 2.4 VALVES
 - 2.4.1 Check Valves
 - 2.4.2 Gate Valves
 - 2.4.3 Pressure Reducing Valves
- 2.5 VALVE BOXES
- 2.6 VALVE PITS
- 2.7 FLUSH HYDRANTS
- 2.8 MISCELLANEOUS ITEMS
 - 2.8.1 Service Clamps
 - 2.8.2 Corporation Stops
 - 2.8.3 Goosenecks
 - 2.8.4 Service Stops
 - 2.8.5 Tapping Sleeves

- 2.8.6 Service Boxes
- 2.8.7 Disinfection
- 2.8.8 Strainers

PART 3 EXECUTION

3.1 INSTALLATION

- 3.1.1 Cutting of Pipe
- 3.1.2 Adjacent Facilities
 - 3.1.2.1 Water Lines
 - 3.1.2.2 Copper Tubing
 - 3.1.2.3 Nonferrous Metallic Pipe
 - 3.1.2.4 Casing Pipe
- 3.1.3 Joint Deflection
 - 3.1.3.1 Flexible Plastic Pipe
 - 3.1.3.2 Ductile-Iron Pipe
- 3.1.4 Placing and Laying
 - 3.1.4.1 Plastic Pipe Installation
 - 3.1.4.2 Connections
 - 3.1.4.3 Penetrations
 - 3.1.4.4 Flanged Pipe
- 3.1.5 Jointing
 - 3.1.5.1 Polyethylene (PE) Pipe
 - 3.1.5.2 Polyvinyl Chloride (PVC) Plastic Pipe
 - 3.1.5.3 Ductile-Iron Pipe
 - 3.1.5.4 Copper Tubing
 - 3.1.5.5 Bonded Joints
 - 3.1.5.6 Isolation Joints and Dielectric Fittings
 - 3.1.5.7 Connections
- 3.1.6 Service Lines
 - 3.1.6.1 Service Lines 2 Inches and Smaller
- 3.1.7 Setting of Flush Hydrants, Valves and Valve Boxes
 - 3.1.7.1 Flush Hydrants
 - 3.1.7.2 Valves
 - 3.1.7.3 Service Boxes
- 3.1.8 Thrust Restraint
 - 3.1.8.1 Thrust Blocks
 - 3.1.8.2 Restrained Joints
- 3.2 HYDROSTATIC TESTS
 - 3.2.1 Pressure Test
 - 3.2.2 Leakage Test
 - 3.2.3 Time for Making Test
 - 3.2.4 Concurrent Hydrostatic Tests
- 3.3 DISINFECTION
 - 3.3.1 Bacteriological Disinfection
- 3.4 CLEANUP

-- End of Section Table of Contents --

SECTION 02660

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM B 88 | (1993a) Seamless Copper Water Tube |
| ASTM D 1784 | (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds |
| ASTM D 1785 | (1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 |
| ASTM D 2241 | (1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) |
| ASTM D 2464 | (1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D 2466 | (1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 |
| ASTM D 2467 | (1993) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D 2564 | (1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems |
| ASTM D 2657 | (1990) Heat-Joining Polyolefin Pipe and Fittings |
| ASTM D 2855 | (1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings |
| ASTM F 477 | (1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|--------------|---|
| ASME B1.20.1 | (1983; R 1992) Pipe Threads, General Purpose (Inch) |
| ASME B16.26 | (1988) Cast Copper Alloy Fittings for |

Flared Copper Tubes

AMERICAN WATER WORKS ASSOCIATION (AWWA)

| | |
|-----------|--|
| AWWA B300 | (1992) Hypochlorites |
| AWWA B301 | (1992) Liquid Chlorine |
| AWWA C104 | (1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water |
| AWWA C110 | (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids |
| AWWA C111 | (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| AWWA C153 | (1994) Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids |
| AWWA C500 | (1993) Gate Valves for Water and Sewerage Systems |
| AWWA C600 | (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances |
| AWWA C606 | (1987) Grooved and Shouldered Joints |
| AWWA C800 | (1989) Underground Service Line Valves and Fittings |
| AWWA C900 | (1989; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution |
| AWWA C901 | (1988; Errata Apr 1988) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service |
| AWWA C905 | (1988) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In. |
| AWWA M23 | (1980) Manual: PVC Pipe - Design and Installation |

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

| | |
|----------|--|
| DIPRA-01 | (1992; Errata May 1993) Thrust Restraint Design for Ductile Iron Pipe |
|----------|--|

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49 (1991) Hazardous Chemicals Data

NFPA 325M (1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

NFPA 704 (1990) Identification of the Fire Hazards of Materials

NSF INTERNATIONAL (NSF)

NSF Std 14 (1965; Rev Nov 1990) Plastics Piping System Components and Related Materials

1.2 PIPING

This section covers water distribution and service lines, and connections to building service at a point approximately 5 feet outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Piping for water service lines less than 3 inches in diameter shall be polyvinyl chloride (PVC) plastic, polyethylene, or copper tubing, unless otherwise shown or specified. Piping for water service lines for sizes 3 inches and larger shall be ductile iron polyvinyl chloride (PVC) plastic through 12 inch nominal diameter, unless otherwise shown or specified.

1.2.2 Distribution Lines 3 Inches or Larger

Piping for water distribution lines 3 inches or larger shall be ductile iron or polyvinyl chloride (PVC) plastic through 12 inch nominal diameter, unless otherwise shown or specified.

1.2.3 Plastic Pipe

All plastic piping system components (PVC or polyethylene) intended for transportation of potable water shall comply with NSF Std 14 and shall be legibly marked with their symbol.

1.2.4 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Installation; FIO.

The manufacturer's recommendations for each material or procedure to be utilized.

SD-08 Statements

Waste Water Disposal Method; GA.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation; FIO.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

1.4 HANDLING

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.4.1 Polyethylene (PE) Pipe

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

1.4.2 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 Polyethylene Plastic (PE)

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

2.1.1.2 Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Pipe Less Than 4 inch Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785. Schedule 40 with joints meeting the requirements of 200 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

b. Pipe 4 Inch through 12 Inch Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

c. Pipe 14 Inch through 36 Inch Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

2.1.2 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, working pressure not less than 150 psi, unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard.

2.1.3 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K, annealed.

2.2 FITTINGS AND SPECIALS

2.2.1 Polyvinyl Chloride (PVC) Pipe

a. For pipe less than 4 inch diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings, fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467, and fittings for elastomeric-gasket

joint pipe shall be iron conforming to AWWA C110 or AWWA C111.

- b. For pipe 4 inch diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 200 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900.

2.2.2 Ductile-Iron Pipe

Fittings and special shall be suitable for 200 psi pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to AWWA C110. Fittings and specials for use with push-on joint pipe shall conform to AWWA C110 and AWWA C111. Fittings and specials for grooved and shouldered end pipe shall conform to AWWA C606. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

2.2.3 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.2.4 Copper Tubing

Fittings and specials shall be flared and conform to ASME B16.26.

2.3 JOINTS

2.3.1 Plastic Pipe

2.3.1.1 Polyethylene (PE) Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation as approved by the Contracting Officer.

2.3.1.2 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Contracting Officer.

2.3.2 Ductile-Iron Pipe

- a. Mechanical joints shall be of the stuffing box type and shall conform to AWWA C111.
- b. Push-on joints shall conform to AWWA C111.
- c. Rubber gaskets and lubricant shall conform to the applicable requirements of AWWA C111.

2.3.3 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

- a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.

2.3.4 Copper Tubing

Joints shall be compression-pattern flared and shall be made with fittings hereinafter specified.

2.4 VALVES

2.4.1 Check Valves

Check valves shall be designed for a minimum working pressure of 200 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 2 inches and larger shall be outside lever and spring.

- a. Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.

2.4.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counter-clockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

- a. Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.
- b. Valves 3 inches and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.

2.4.3 Pressure Reducing Valves

Pressure reducing valves shall maintain a constant downstream pressure regardless of fluctuations in demand. Valves shall be suitable for 110 psi operating pressure on the inlet side, with outlet pressure set for 65 psi.

(Existing pressure shall be verified before ordering valve). The valves shall be of a balanced direct acting single seat design with a minimum flow characteristic of "0" gallons per minute. The valve shall close drip tight when the downstream pressures rise above the spring setting. No pressure "creep" or leak can be tolerated. The valve body and cover shall be bronze construction. Trim shall be of 416 stainless steel and shall contain an integral 416 stainless steel strainer. The disk shall be Buna N and diaphragm reinforced neoprene. All necessary maintenance and repairs shall be possible without removing the valve body from the line. The 1-1/4 inch valve shall have no more than a 15 psi head loss at a flow rate of 50 gpm.

The self-contained pressure reducing insert, complete with strainer, is to be replaceable without removing valve from line. The seat/diaphragm assembly shall be fully guided at both the top and bottom.

The valve shall be constructed with union tailpieces (NPT) at the inlet and outlet. It shall be possible to check the pressure of the downstream side of the valve from the threaded tapings on either side of the valve body with a pressure gauge.

2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 3000 psi in accordance with Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7 FLUSH HYDRANTS

Flush hydrants shall be compressed type with a 3 foot bury. Outlets shall have American National Standard hose coupling threads. Working parts shall be bronze or brass. Design, material, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be anti-freezing, self-draining. Hydrants shall include 7 cubic feet of gravel to facilitate drainage and a 2' x 2' x 4" concrete slab centered around hydrant.

2.8 MISCELLANEOUS ITEMS

2.8.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.8.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.

2.8.3 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B 88, Type K, annealed. Length of cable requirement connections shall be in accordance with standard practice.

2.8.4 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 200 psi.

2.8.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable-iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 266 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.8.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.8.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

2.8.8 Strainers

Strainers shall be "Y" type with iron body and monel or stainless steel 20 mesh screen rated for 400 psi working pressure. The free area through the screen shall be four times the pipe area. The clean out plug and screen shall be removeable without removing the strainer from the line. The clean out shall be equipped with a blow off port and valve for self cleaning of large quantities of sediment.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.2 Copper Tubing

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.3 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches shall be maintained between pipes.

3.1.2.4 Casing Pipe

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. Where sleeves are required, in all other cases, the pipe sleeve shall be as specified for storm drains in Section 02720 STORM-DRAINAGE SYSTEM. A minimum clearance of at least 2 inches between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding or suitable pipe support shall be provided for the water pipe through the sleeve.

3.1.3 Joint Deflection

3.1.3.1 Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but in no case shall it exceed 5 degrees.

3.1.3.2 Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Plastic Pipe Installation

PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be installed in accordance with AWWA M23.

3.1.4.2 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA-01.

3.1.4.3 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.4.4 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.5 Jointing

3.1.5.1 Polyethylene (PE) Pipe

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

3.1.5.2 Polyvinyl Chloride (PVC) Plastic Pipe

- a. Pipe less than 4 inch diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque,

joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with requirements of ASTM F 477 and as required herein. All pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to the requirements of ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.

- b. Pipe 4 inch through 12 inch diameter: Joints shall be elastomeric-gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 4 inch diameter with configuration using elastomeric ring gasket.
- c. Pipe 14 inch through 36 inch diameter: Joints shall be elastomeric-gasket push-on joints made in accordance with AWWA M23.

3.1.5.3 Ductile-Iron Pipe

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and shouldered pipe above ground or in pits.

3.1.5.4 Copper Tubing

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

3.1.5.5 Bonded Joints

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

3.1.5.6 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS AND FITTINGS AND SPECIALS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 1/8 inch thickness of coal tar over all fitting surfaces.

3.1.5.7 Connections

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 5 feet outside the building where such building service

exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 5 feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 Service Lines 2 Inches and Smaller

Service lines 2 inches and smaller shall be connected to the main by a tee.

3.1.7 Setting of Flush Hydrants, Valves and Valve Boxes

3.1.7.1 Flush Hydrants

Flush hydrants shall be located and installed as shown per manufacturer's recommendation. Each hydrant shall be connected to the main with a 2 inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 24 inches above the finished surrounding grade, and the operating nut not more than 36 inches above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation of obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 4 inches thick and 15 inches square. Not less than 7 cubic feet of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.7.2 Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box or pit to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

3.1.7.3 Service Boxes

Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.8 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile iron pipes, restrained joints.

3.1.8.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.8.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-01.

3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.2.1 Pressure Test

After the pipe is laid, the joints completed, flush hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

- a. Wet or unstable soil conditions in the trench.
- b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.
- c. Maintaining the trench in an open condition would delay completion of the contract.
- d. An unforeseeable cause which would result in excess cost.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$$L = 0.0001351ND(P \text{ raised to } 1/2 \text{ power})$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

- a. Pressure test and leakage test may be conducted concurrently.
- b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 DISINFECTION

3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as specified herein. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. In no case will the agent be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times. From several points in the unit, the Contracting Officer will take samples of water in proper sterilized containers for bacterial examination. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained. Testing shall be by an approved laboratory provided by the contractor.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02720

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
 - 1.3.1 Delivery and Storage
 - 1.3.2 Handling

PART 2 PRODUCTS

- 2.1 PIPE FOR CULVERTS AND STORM DRAINS
 - 2.1.1 Steel Pipe
 - 2.1.1.1 Fully Bituminous Coated
- 2.2 MISCELLANEOUS MATERIALS
 - 2.2.1 Concrete
 - 2.2.2 Joints
 - 2.2.2.1 External Sealing Bands
 - 2.2.2.2 Flexible Watertight, Gasketed Joints
- 2.3 HYDROSTATIC TEST ON WATERTIGHT JOINTS
 - 2.3.1 Corrugated Steel and Aluminum Pipe

PART 3 EXECUTION

- 3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES
 - 3.1.1 Trenching
 - 3.1.2 Removal of Rock
 - 3.1.3 Removal of Unstable Material
- 3.2 BEDDING
 - 3.2.1 Concrete Pipe
 - 3.2.2 Clay Pipe
 - 3.2.3 Corrugated Metal Pipe
 - 3.2.4 Ductile Iron Pipe
 - 3.2.5 Plastic Pipe
- 3.3 PLACING PIPE
 - 3.3.1 Corrugated Metal Pipe and Pipe Arch
 - 3.3.2 Multiple Culverts
- 3.4 JOINTS
 - 3.4.1 Corrugated Metal Pipe
 - 3.4.1.1 Field Joints
 - 3.4.2 Flexible Watertight, Gasketed Joints
- 3.5 BACKFILLING
 - 3.5.1 Backfilling Pipe in Trenches
 - 3.5.2 Backfilling Pipe in Fill Sections
 - 3.5.3 Movement of Construction Machinery
- 3.6 COMPACTION
 - 3.6.1 General

3.6.2 Minimum Density

3.6.3 Determination of Density

-- End of Section Table of Contents --

SECTION 02720

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

- | | |
|--------------|---|
| AASHTO M 190 | (1988) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches |
| AASHTO M 198 | (1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets |
| AASHTO M 243 | (1994) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|---|
| ASTM A 760 | (1995a) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains |
| ASTM A 798 | (1994) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications |
| ASTM A 807 | (1996) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications |
| ASTM C 12 | (1995) Installing Vitrified Clay Pipe Lines |
| ASTM C 231 | (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C 443 | (1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets |
| ASTM C 877 | (1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe |
| ASTM D 1056 | (1991) Flexible Cellular Materials - Sponge or Expanded Rubber |

| | |
|-------------|---|
| ASTM D 1171 | (1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens) |
| ASTM D 1557 | (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.)) |
| ASTM D 1751 | (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D 1752 | (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |
| ASTM D 2167 | (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| ASTM D 2321 | (1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications |
| ASTM D 2922 | (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| ASTM D 3017 | (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Placing Pipe; FIO.

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates

Pipe Materials; GA.

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly

on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.

1.3.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Steel Pipe

2.1.1.1 Fully Bituminous Coated

AASHTO M 190 Type A and ASTM A 760 zinc coated pipe of either:

- a. Type I or II pipe with annular or helical corrugations.
- b. Type IR or IIR pipe with helical corrugations.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 3,000 psi concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.2.2 Joints

2.2.2.1 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877.

2.2.2.2 Flexible Watertight, Gasketed Joints

- a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8-inch thick, meeting the requirements of ASTM D 1056, Type 2 A1 or B3, and shall have a quality retention rating of not less than 70 percent

when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 13/16-inch in diameter for pipe diameters of 36 inches or smaller and 7/8-inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

- b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.3 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.3.1 Corrugated Steel and Aluminum Pipe

A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO HB-16 (Division II, Section 26). The pipe will be supported for the hydrostatic test so that the joint is located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in feet for the pipe flowing full or 40,000 foot-pounds, whichever is less. Performance requirements shall be met at an internal hydrostatic pressure of 10 psi for a 10 minute period for both annular corrugated metal pipe and helical corrugated metal pipe with factory reformed ends.

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches and for appurtenances and backfilling for culverts and storm drains shall be in accordance with the applicable portions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and Section 02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 24 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing where required shall be placed within the trench width as specified. Care shall be taken not to overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2-inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Rock excavation shall be as specified and defined in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Depressions for joints shall be only of such length, depth, and width as required for properly making the particular type of joint.

3.2.2 Clay Pipe

Bedding for clay pipe shall be as specified by ASTM C 12.

3.2.3 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, it is recommended to either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A 807.

3.2.4 Ductile Iron Pipe

Bedding for ductile iron pipe shall meet requirements of ASTM A716

3.2.5 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 PLACING PIPE

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering

sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall be inspected before backfilling, and those pipes damaged during placement shall be removed and replaced.

3.3.1 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During installation, pipe or pipe arch shall be handled with care to preclude damage to the bituminous coating or paving. Prior to placing backfill, damaged areas of coupling bands and pipe shall be given a coating of bituminous material, specified in AASHTO M 190 or AASHTO M 243. Pipe on which bituminous coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.3.2 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4 JOINTS

3.4.1 Corrugated Metal Pipe

3.4.1.1 Field Joints

Transverse field joints shall be of such design that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous

material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall then be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket shall be closely observed to see that it is seating properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

3.5 BACKFILLING

3.5.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 6 inches. Tests for density will be made as necessary to ensure conformance to the compaction requirements specified elsewhere in this paragraph. Where it is necessary in the opinion of the Contracting Officer, any sheeting or portions of bracing used shall be left in place and the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.5.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified elsewhere in this paragraph. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12

feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8 inches.

3.5.3 Movement of Construction Machinery

In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6 COMPACTION

3.6.1 General

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density (densities) which will be determined as specified in this paragraph.

- a. Under paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.3 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of

soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02740

SEPTIC SYSTEM

PART 1 GENERAL

- 1.1 SUMMARY (NOT APPLICABLE)
- 1.2 REFERENCES
- 1.3 SYSTEM DESCRIPTION
- 1.4 QUALITY ASSURANCE

PART 2 PRODUCTS

- 2.1 SEPTIC TANK
- 2.2 PRECAST CONCRETE
- 2.3 CASTINGS
- 2.4 FIELD LINES
- 2.5 FILTER MATERIAL
- 2.6 CONNECTING LINE (DUCTILE IRON PIPE)
- 2.7 CONNECTING LINE (PVC PIPE)
- 2.8 HATCH

PART 3 EXECUTION

- 3.1 SEPTIC TANK
- 3.2 PRECAST UNITS
- 3.3 DRAIN FIELD
- 3.4 CONNECTING LINES INCLUDING FORCE MAINS

-- End of Section Table of Contents --

SECTION 02740

SEPTIC SYSTEM

PART 1 GENERAL

1.1 SUMMARY (NOT APPLICABLE)

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM A 48 | (1983) Gray Iron Castings |
| ASTM D 448 | (1980) Specifications for Standard Sizes of Coarse Aggregate for Highway Construction |
| ASTM C 478 | (1988a) Precast Reinforced Concrete Manhole Sections |
| ASTM D 2729 | (1988) Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings |
| ASTM D 3034 | (1988) Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings |

AMERICAN WATER WORKS ASSOCIATION

| | |
|------------|--|
| AWWA C 151 | (1986) Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids |
|------------|--|

KENTUCKY DEPARTMENT OF HEALTH SERVICES

| | |
|----------------|--|
| 902 KAR 10:081 | Construction Standards for Components of Onsite Disposal Systems |
| 902 KAR 10:085 | Kentucky Onsite Sewage Disposal Systems Regulations |

1.3 SYSTEM DESCRIPTION

Extent of septic system work is shown on drawings. The Contractor shall furnish and install a complete septic tank sewage disposal system complete and operating as indicated in the Plans and these Specifications. Septic system work includes, but is not limited to the following:

Septic Tank

Manholes
Inspection Ports
Gravity Distribution Beds
Connecting Lines
Distribution Boxes
Filter Material
Automatic Dosing Siphon (See Section 02752 SIPHONS, DOSING)

1.4 QUALITY ASSURANCE

The septic tank system installer shall have not less than two (2) years experience installing septic systems. Tank manufacturer shall be a state and county approved manufacturer.

Comply with requirements of all local regulatory agencies having jurisdiction and National Standard Plumbing Code (NSPC).

All work shall conform with the standards set forth in 902 KAR 10:081 and 902 KAR 10:085.

PART 2 PRODUCTS

2.1 SEPTIC TANK

Construct reinforced concrete septic tank of size and capacity as shown on drawings. Coat inner surfaces of septic tank including wet well with heavy coating of bituminous mastic. Septic tank to meet standards set forth in 902 KAR 10:081 and 902 KAR 10:085.

2.2 PRECAST CONCRETE

Precast concrete manholes shall be in accordance with ASTM C 478 as applicable.

2.3 CASTINGS

Manhole rings and covers gray cast iron, ASTM A 48, Class 20 - Submit shop drawings.

2.4 FIELD LINES

Field lines shall be perforated, PVC pipe and shall be in accordance with ASTM D 2729.

Furnish drainage pipe complete with bends, adapters, couplings, collars, and joint materials, to suit project.

2.5 FILTER MATERIAL

Filter material shall be washed, crushed stone or gravel, graded from 2-1/2" to 3/4", ASTM D 448, Size 24.

2.6 CONNECTING LINE (DUCTILE IRON PIPE)

Ductile iron pipe shall be designed in accordance with AWWA C 151.

2.7 CONNECTING LINE (PVC PIPE)

PVC pipe shall be SDR 35 PVC, ASTM D 3034.

2.8 HATCH

The hatch shall be an aluminum angle frame access hatch unit designed for 300 pounds per square foot loading. The cover plate shall be a minimum of 1/4-inch plate. Hinges shall be stainless steel, mounted and stainless steel bolts. Provide a drop handle, hold open arm and staple for locking.

PART 3 EXECUTION

3.1 SEPTIC TANK

Excavate for septic tank installation and verify elevation and layout. Construct tank in accordance with Division 3, Concrete. Cast all manhole rings, door units and openings in place. The tank shall not be cut or drilled after concrete has been poured.

3.2 PRECAST UNITS

Excavate for structure and check grade to verify complete excavation to elevations and slopes indicated. Install units in a level bottom excavation on a bed of 3" gravel. Backfill in 12" layers mechanically tamping each layer before placing the next layer.

3.3 DRAIN FIELD

Construction methods shall comply with 902 KAR 10:081 and 902 KAR 10:085. Pipe shall be installed in accordance with these specifications and ASTM D 2321.

Place supporting layer of filtering material over excavated trench base to compacted depth as indicated or, if not indicated, to a compacted depth not less than 6" below bottom of pipe.

Drain pipe solidly bedded in filtering material. Provide full bearing for each pipe section throughout its length, to true grades and alignment, and continuous slope in direction of flow.

Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturer's recommendations. Provide collars and couplings as required.

After drain lines have been installed, place additional filtering material around sides and top to compacted depth as indicated or, if not indicated, to a compacted depth of 8" above top of pipe.

Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

Cover filtering material with one layer of untreated building paper and immediately backfill trench with excavated soil, mounding but not compacting soil above original grade. Do not permit construction equipment on backfilled trenches.

3.4 CONNECTING LINES INCLUDING FORCE MAINS

The trench shall be dug to the alignment and depth required and only so far in advance of pipe laying as necessary.

The trench width may vary with and depend upon the depth of trench and the nature of the excavated material encountered, but in all casts shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly.

The trench, unless otherwise specified, shall have a flat bottom, conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil cut true and even so that the barrel of the pipe will have a bearing for its full length.

Any part of the trench excavated below grade shall be corrected with approved material, thoroughly compacted.

Bell holes of ample dimensions shall be dug in earth trenches at each joint to permit the jointing to be properly made.

All surface materials suitable for reuse in restoring the surface shall be kept separate from the general excavation material.

Adequate provisions shall be made for the flow of sewers, drains, and water courses encountered during construction, and the structures which may have been disturbed shall be satisfactorily restored upon completion of the work.

Trees, fences, poles and all other property shall be protected unless their removal is authorized; and any property damaged shall be satisfactorily restored by the Contractor.

Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench, piece by piece, by means of a derrick, ropes, or other suitable tools and equipment, in such manner as to prevent damage to pipe. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

All foreign matter or dirt shall be removed from the inside before pipe is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying.

The pipe shall be placed in position, and brought into the alignment joined and be secured there with earth carefully tamped under and on each side of it, excepting at the bell holes. Care shall be taken to prevent dirt from entering the joint space.

Backfill material shall be free from rocks or boulders and shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench in 4-inch layers to an elevation of at least 6 inches above the top of the barrels of the pipe, leaving the joints exposed for examination during the pressure test as previously specified. Material shall be dry enough to compact to the equivalent density to the surrounding earth. If too dry, the backfill material shall be dampened. Backfill containing broken pavement shall not be used.

Backfill shall be in 6-inch layers, tamped with hand tamps to 6 inches above top of pipe and the remainder shall be in one foot increments and mechanically tamped if directed.

Any deficiency in the quantity of material for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the

Contractor at no cost to the Owner.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02752

SIPHONS, DOSING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT
 - 2.1.1 Pipe
 - 2.1.1.1 Cast Iron
 - 2.1.1.2 Polyvinyl Chloride (PVC)
 - 2.1.1.3 Polyethylene
 - 2.1.2 Pipe Fittings
 - 2.1.2.1 Cast Iron
 - 2.1.2.2 Polyvinyl Chloride (PVC)
 - 2.1.2.3 Polyethylene
 - 2.1.2.4 Malleable-Iron
 - 2.1.2.5 Malleable-Iron Unions
 - 2.1.3 Siphon Bells, Inlet Castings, and Similar Equipment
 - 2.1.3.1 Cast Iron
 - 2.1.3.2 Polyvinyl Chloride (PVC)
 - 2.1.3.3 Polyethylene
 - 2.1.4 Valves

PART 3 EXECUTION

- 3.1 WORKMANSHIP
- 3.2 SIPHONS
- 3.3 PIPING
- 3.4 PAINTING

-- End of Section Table of Contents --

SECTION 02752

SIPHONS, DOSING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|---|
| ASTM A 48 | (1994a) Gray Iron Castings |
| ASTM D 3034 | (1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings |
| ASTM D 3350 | (1993) Polyethylene Plastics Pipe and Fittings Materials |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- | | |
|-------------|---|
| ASME B16.3 | (1992) Malleable Iron Threaded Fittings |
| ASME B16.39 | (1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300 |

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- | | |
|-----------|---|
| AWWA C110 | (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., (75 mm through 1200 mm) for Water and Other Liquids |
| AWWA C111 | (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| AWWA C151 | (1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids |

FEDERAL SPECIFICATIONS (FS)

- | | |
|-------------|---|
| FS WW-P-421 | (Rev. D) Pipe, Cast, Gray and Ductile Iron, Pressure (for Water and Other Liquids) |
|-------------|---|

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

- | | |
|-----------|--|
| MSS SP-80 | (1987) Bronze Gate, Globe, Angle and Check Valves |
|-----------|--|

1.2 SYSTEM DESCRIPTION

The dosing siphon shall be a deep seal type suitable for the service

required, shall be completely automatic in operation, shall start promptly when the sewage has reached the predetermined high water level, and shall shutoff positively at the low water level. Starting, stopping, and alternating operations shall be accomplished without the use of electrical or mechanical devices having moving parts. Capacities of equipment and materials shall be not less than those specified or indicated. Each siphon bell shall have the manufacturer's name, address, and catalog or model number on a plate securely in a conspicuous place. In lieu of nameplate, the manufacturer's name or trademark may be cast integrally with the equipment, or standard, or otherwise permanently marked.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Dosing Siphon System; FIO.

Data shall include catalog numbers, cuts, and other descriptive data required to assure compliance with the specifications.

SD-04 Drawings

Dosing Siphon System; GA.

Complete drawings and such other descriptive data as the Contracting Officer may require to demonstrate compliance with the contract documents, not less than 30 days before starting installation of any materials or equipment. Drawings shall be submitted at one time. If departure from the contract drawings is deemed necessary by the Contractor details of such departure, including changes in related portions of the project and the reasons therefor, shall be submitted with the drawings. Approved departures shall be made at no additional cost to the Government.

SD-07 Schedules

Dosing Siphon System; GA.

A complete list in triplicate of materials and equipment to be incorporated in the work, within 45 working days of receipt of notice to proceed, and before starting installation of any materials or equipment. A complete list in triplicate of parts and supplies for each different item of equipment listed, with current unit prices and sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or are specified herein to be furnished as a part of the contract, and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days, not later than four months prior to the date of beneficial use.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the respective publications and other requirements specified below. Other materials and equipment shall be

as specified herein and as shown on the drawings, and shall be the products of manufacturers regularly engaged in the manufacture of such products. Materials and equipment shall essentially duplicate items that have been in satisfactory use at least 2 years prior to bid opening.

2.1.1 Pipe

2.1.1.1 Cast Iron

FS WW-P-421, Type II or III.

2.1.1.2 Polyvinyl Chloride (PVC)

ASTM D 3034.

2.1.1.3 Polyethylene

ASTM D 3350.

2.1.2 Pipe Fittings

2.1.2.1 Cast Iron

FS WW-P-421, Type II or III.

2.1.2.2 Polyvinyl Chloride (PVC)

ASTM D 3034.

2.1.2.3 Polyethylene

ASTM D 3350.

2.1.2.4 Malleable-Iron

ASME B16.3.

2.1.2.5 Malleable-Iron Unions

ASME B16.39.

2.1.3 Siphon Bells, Inlet Castings, and Similar Equipment

2.1.3.1 Cast Iron

ASTM A 48.

2.1.3.2 Polyvinyl Chloride (PVC)

ASTM D 3034.

2.1.3.3 Polyethylene

ASTM D 3350.

2.1.4 Valves

Bronze, MSS SP-80.

PART 3 EXECUTION

3.1 WORKMANSHIP

The dosing siphons shall be installed in accordance with the recommendations of the manufacturer as approved. The installation shall be made by workers experienced in the installation of this type of equipment.

3.2 SIPHONS

Siphon bells, air bells, inlet castings, and similar equipment shall be cast iron, polyvinyl chloride (PVC) or polyethylene. Siphon bells shall be provided with suitable connections for the air-control piping and the sniff pipe shall be mounted over the 4 inch diameter feed pipe. Each siphon shall be capable of discharging at a maximum rate of flow of 140 gallons per minute while operating under a drawing depth of 16 inches, and under the head conditions as indicated on the drawings. The air piping shall be so arranged and valved as to permit removal of any number of the siphons from service without disturbing the alternating operation of the remaining siphons. Equipment for twin dosing tanks shall include air bells, air-locking inflow connection, and all similar equipment that may be necessary to alternate the inflow from one tank to the other and to prevent flow into the tank while the siphon in the tank is discharging.

3.3 PIPING

The overflow pipe, feed pipe, air control and sniff pipe may be cast iron, polyvinyl chloride (PVC), or polyethylene. Cast iron pipes shall be installed with malleable-iron fittings and bronze valves. Cast iron pipe shall be installed with sufficient malleable-iron unions to facilitate maintenance or removal, and shall be assembled using a stiff mixture of graphite and oil, or an inert filler and oil, or an approved graphite compound, applied with a brush to the male thread only.

3.4 PAINTING

The equipment shall be thoroughly cleaned, primed, and given finish painting at the factory in accordance with the recommendations of the manufacturer. Field painting is specified in Section 09900 PAINTING, GENERAL.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SAFETY
- 1.4 TEST REQUIREMENTS
- 1.5 EQUIPMENT
 - 1.5.1 Joint Cleaning Equipment
 - 1.5.1.1 Concrete Saw
 - 1.5.1.2 Sandblasting Equipment
 - 1.5.1.3 Hand Tools
 - 1.5.2 Sealing Equipment
 - 1.5.2.1 Hot-Poured Sealing Equipment
 - 1.5.2.2 Two-Component, Cold-Applied, Machine Mix Sealing Equipment
- 1.6 DELIVERY AND STORAGE
- 1.7 ENVIRONMENTAL CONDITIONS

PART 2 PRODUCTS

- 2.1 SEALANTS
- 2.2 PRIMERS
- 2.3 BACKUP MATERIALS
- 2.4 BOND BREAKING TAPES

PART 3 EXECUTION

- 3.1 PREPARATION OF JOINTS
 - 3.1.1 Sawing
 - 3.1.1.1 Facing of Joints
 - 3.1.2 Sandblasting
 - 3.1.3 Back-Up Material
 - 3.1.4 Bond Breaking Tape
 - 3.1.5 Rate of Progress of Joint Preparation
- 3.2 PREPARATION OF SEALANT
 - 3.2.1 Hot-Poured Sealants
- 3.3 INSTALLATION OF SEALANT
 - 3.3.1 Time of Application
 - 3.3.2 Sealing Joints
- 3.4 INSPECTION
 - 3.4.1 Joint Cleaning
 - 3.4.2 Joint Sealant Application Equipment
 - 3.4.3 Joint Sealant
- 3.5 CLEAN-UP

-- End of Section Table of Contents --

SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM C 509 | (1994) Elastomeric Cellular Preformed Gasket and Sealing Material |
| ASTM D 789 | (1994) Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA) |
| ASTM D 3405 | (1994) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements |

FEDERAL SPECIFICATIONS (FS)

| | |
|-------------|--|
| FS SS-S-200 | (Rev E; Am 2) Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement |
|-------------|--|

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Manufacturer's Recommendations; GA.

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations, 30 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

SD-07 Schedules

Construction Equipment List; FIO.

List of proposed equipment to be used in performance of construction work

including descriptive data, 30 days prior to use on the project.

1.3 SAFETY

Joint sealant shall not be placed within 25 feet of any liquid oxygen (LOX) equipment, LOX storage, or LOX piping. Joints in this area shall be thoroughly cleaned and left unsealed.

1.4 TEST REQUIREMENTS

The joint sealant and backup or separating material shall be tested for conformance with the referenced applicable material specification. The materials will be tested by the Government. No material shall be used at the project prior to receipt of written notice that the materials meet the laboratory requirements. The cost of the first test of samples shall be borne by the Government. If the samples fail to meet specification requirements, the materials represented by the sample shall be replaced and the new materials tested at the Contractor's expense. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.5.1 Joint Cleaning Equipment

1.5.1.1 Concrete Saw

A self-propelled power saw with water-cooled diamond or abrasive saw blades will be provided for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

1.5.1.2 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 1/4-inch. The air compressor shall be portable and shall be capable of furnishing not less than 150 cubic feet per minute and maintaining a line pressure of not less than 90 psi at the nozzle while in use. Compressor capability under job conditions must be demonstrated before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjusted as necessary to secure satisfactory results.

1.5.1.3 Hand Tools

Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

1.5.2 Sealing Equipment

1.5.2.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing ASTM D 3405 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

1.5.2.2 Two-Component, Cold-Applied, Machine Mix Sealing Equipment

The equipment used for proportioning, mixing, and installing FS SS-S-200 Type M joint sealants shall be designed to deliver two semifluid components through hoses to a portable mixer at a preset ratio of 1 to 1 by volume using pumps with an accuracy of plus or minus 5 percent for the quantity of each component. The reservoir for each component shall be equipped with mechanical agitation devices that will maintain the components in a uniform condition without entrapping air. Provisions shall be incorporated to permit thermostatically controlled indirect heating of the components, when required. However, immediately prior to proportioning and mixing, the temperature of either component shall not exceed 90 degrees F. Screens shall be provided near the top of each reservoir to remove any foreign particles or partially polymerized material that could clog fluid lines or otherwise cause misproportioning or improper mixing of the two components. The equipment shall be capable of thoroughly mixing the two components through a range of application rates of 10 to 60 gallons per hour and through a range of application pressures from 50 to 1500 psi as required by material, climatic, or operating conditions. The mixer shall be designed for the easy removal of the supply lines for cleaning and proportioning of the components. The mixing head shall accommodate nozzles of different types and sizes as may be required by various operations. The dimensions of the nozzle shall be such that the nozzle tip will extend into the joint to allow sealing from the bottom of the joint to the top. The initially approved equipment shall be maintained in good working condition, serviced in accordance with the supplier's instructions, and shall not be altered in any way without obtaining prior approval.

1.6 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided by the Contractor at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.7 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 50 degrees F and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

PART 2 PRODUCTS

2.1 SEALANTS

Materials for sealing cracks in the various paved areas indicated on the drawings shall be as follows:

| Area | Sealing Material |
|--------------|------------------|
| Turning Pads | ASTM D 3405 |

2.2 PRIMERS

Primers, when their use is recommended by the manufacturer of the sealant, shall be as recommended by the manufacturer of the sealant.

2.3 BACKUP MATERIALS

The backup material shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

2.4 BOND BREAKING TAPES

The bond breaking tape or separating material shall be a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The bond breaker tape shall be approximately 1/8 inch wider than the nominal width of the joint and shall not bond to the joint sealant.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, protrusions of hardened concrete, and old sealant from the sides and upper edges of the joint space to be sealed.

3.1.1 Sawing

3.1.1.1 Facing of Joints

Facing of joints shall be accomplished using a concrete saw as specified in paragraph EQUIPMENT. The blade shall be stiffened with a sufficient number of suitable dummy (used) blades or washers. Immediately following the sawing operation, the joint opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris. The saw shall be equipped with a device for forming a 1/4 inch radius on each side of the joint.

3.1.2 Sandblasting

The newly exposed concrete joint faces and the pavement surfaces extending a minimum of 1/2 inch from the joint edges shall be sandblasted clean. A multiple-pass technique shall be used until the surfaces are free of dust, dirt, curing compound, filler, old sealant residue, or any foreign debris that might prevent the bonding of the sealant to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

3.1.3 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the specified depth. Care shall be taken to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.4 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

3.1.5 Rate of Progress of Joint Preparation

The stages of joint preparation which include sandblasting, air pressure cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

3.2.1 Hot-Poured Sealants

Sealants conforming to ASTM D 3405 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint walls and following the placement of the separating or backup material. Open joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing Joints

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 1/4-inch plus or minus 1/16-inch below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The

sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

3.4 INSPECTION

3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02831

CHAIN LINK FENCE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Chain Link Fence
 - 2.1.2 Chain Link Fence Fabric
 - 2.1.3 Gates
 - 2.1.4 Posts
 - 2.1.5 Braces and Rails
 - 2.1.6 Tension Wire
 - 2.1.7 Accessories
 - 2.1.8 Concrete
 - 2.1.9 Padlocks

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 EXCAVATION
- 3.3 POSTS
- 3.4 RAILS
 - 3.4.1 Bottom Rail
- 3.5 BRACES AND TRUSS RODS
- 3.6 TENSION WIRES
- 3.7 CHAIN LINK FABRIC
- 3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE
- 3.9 GATES
- 3.10 GROUNDING

-- End of Section Table of Contents --

SECTION 02831

CHAIN LINK FENCE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM A 121 | (1992a) Zinc-Coated (Galvanized) Steel Barbed Wire |
| ASTM A 153 | (1996) Zinc-Coated (Hot Dip) on Iron and Steel Hardware |
| ASTM A 392 | (1996) Zinc-Coated Steel Chain-Link Fence Fabric |
| ASTM A 491 | (1996) Aluminum-Coated Steel Chain-Link Fence Fabric |
| ASTM A 585 | (1992) Aluminum-Coated Steel Barbed Wire |
| ASTM A 780 | (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings |
| ASTM A 824 | (1992) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence |
| ASTM C 94 | (1996) Ready-Mixed Concrete |
| ASTM F 626 | (1996) Fence Fittings |
| ASTM F 883 | (1990) Padlocks |
| ASTM F 900 | (1994) Industrial and Commercial Swing Gates |
| ASTM F 1043 | (1995) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework |
| ASTM F 1083 | (1996) Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures |
| ASTM F 1184 | (1994) Industrial and Commercial Horizontal Slide Gates |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Chain Link Fence; GA.

Statement signed by an official authorized to certify on behalf of the manufacturer attesting that the chain link fence and component materials meet the specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following:

2.1.1 Chain Link Fence

ASTM A 392. Fence shall be type FE7-TWB-84. Chain link with barbed wire on outrigger, tension, wire top and bottom, 84 inch fabric width.

2.1.2 Chain Link Fence Fabric

ASTM A 392, Class 2, zinc-coated steel wire with minimum coating weight of 2.0 ounces of zinc per square foot of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. Fabric shall be fabricated of 9 gauge wire woven in 2 inch mesh. Fabric height shall be 7 feet. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

2.1.3 Gates

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain-link fabric. Each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Gate leaves more than 8 feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position.

2.1.4 Posts

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or

Type B and Group II , formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

2.1.5 Braces and Rails

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group II , formed steel sections, size 1.66 inch, conforming to ASTM F 1043, may be used as braces and rails if Group II line posts are furnished.

2.1.6 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

2.1.7 Accessories

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Barbed wire shall be 2 strand, 12-1/2 gauge wire, zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the single or V arm type and of the design required for the post furnished. Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the fence fabric. Miscellaneous hardware coatings shall conform to ASTM A 153 unless modified herein.

2.1.8 Concrete

ASTM C 94, using 3/4-inch maximum size aggregate, and having minimum compressive strength of 3,000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.1.9 Padlocks

ASTM F 883, Type PO1, Grade 2, Size 1-3/4 inch. Padlocks shall be keyed alike and each lock shall be furnished with two keys.

PART 3 EXECUTION

3.1 GENERAL

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be

repaired with paint containing zinc dust in accordance with ASTM A 780.

3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

3.3 POSTS

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 3 feet and shall be protected with drive caps when being set. Fence post rigidity shall be tested by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Post movement measured at the point where the force is applied shall be less than or equal to 3/4-inch from the relaxed position. Every tenth post shall be tested for rigidity. When a post fails this test, further tests on the next four posts on either side of the failed post shall be made. All failed posts shall be removed, replaced, and retested at the Contractor's expense.

3.4 RAILS

3.4.1 Bottom Rail

The bottom rail shall be bolted to double rail ends and double rail ends shall be securely fastened to the posts. Bolts shall be peened to prevent easy removal. Bottom rail shall be installed before chain link fabric.

3.5 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed on fences over 6 feet in height. A center brace or 2 diagonal truss rods shall be installed on 12 foot fences. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.6 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 4 inches of the installed fabric. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15 inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 12 inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 1 inch (plus or minus 1/2-inch) above the ground.

3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with hand tools. Supporting arms shall be anchored with 3/8-inch diameter plain pin rivets or, at the Contractor's option, with studs driven by low-velocity explosive-actuated tools for steel, wrought iron, ductile iron, or malleable iron. Studs driven by an explosive-actuated tool shall not be used with gray iron or other material that can be fractured. A minimum of two studs per support arm shall be used. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.9 GATES

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

3.10 GROUNDING

Fences crossed by overhead power lines in excess of 600 volts shall be grounded as specified in Section 16670 LIGHTNING PROTECTION SYSTEM. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 3/4-inch by 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 12 inches deep and radially from the fence. The top of the electrode shall be not less than 2 feet or more than 8 feet from the fence. Ground conductor shall be clamped to the fence, gate, and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, gate, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02836

TRAFFIC SIGNS

PART 1 GENERAL

- 1.1 SUMMARY (NOT APPLICABLE)
- 1.2 REFERENCES
- 1.3 GENERAL REQUIREMENTS
- 1.4 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 FABRICATION
- 3.3 SIGN POSTS AND SUPPORTS
- 3.4 MOUNTING SIGNS

-- End of Section Table of Contents --

SECTION 02836

TRAFFIC SIGNS

PART 1 GENERAL

1.1 SUMMARY (NOT APPLICABLE)

1.2 REFERENCES

Unless otherwise specified, the work shall conform to requirements specified in the following publications:

KENTUCKY DEPARTMENT OF TRANSPORTATION

| | |
|-----------|--|
| KY DOT 01 | Kentucky Manual on Uniform Traffic Control Devices for Streets and Highways |
|-----------|--|

| | |
|-----------|---|
| KY DOT 98 | (1998) Kentucky Standard Specifications for Road and Bridge Construction |
|-----------|---|

1.3 GENERAL REQUIREMENTS

This work shall consist of furnishing and erecting traffic signs in accordance with these specifications and at the location shown on the plans or directed.

1.4 SUBMITTALS

Government approved is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

SD-04 Drawings

Signs and Posts; GA

Detail drawings indicating material thickness, type, grade, and dimensions; and construction details. Drawings shall include manufacturer's descriptive data and installation instructions.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall meet requirements as specified in KY DOT 98.

Class A concrete shall be used in the construction, unless otherwise specified.

Materials for sign lighting, when required, shall meet requirements as

specified in KY DOT 98.

PART 3 EXECUTION

3.1 GENERAL

The plans will indicate the extent and general arrangement of signs and are to be used by the Contractor as general guidance. Sign locations and post lengths indicated on the plans are approximate only. All signs are to be located at the approximate stations listed and the exact location for each sign shall be determined by the Contractor and approved by the Engineer. The Contractor shall allow for differences in elevation across the full shoulder width as shown on the plans in maintaining the required minimum vertical clearance to the bottom of the lowest parts of the signs. All beams and posts shall be of sufficient length to extend from the top of the sign to the base imbedment. When departures from the plans and these specifications are deemed necessary, details of such departures and reasons therefor shall be submitted in writing to the Engineer. Departures will be permitted only upon written approval.

Message spacings shall be in accordance with KY DOT 01, in accordance with the manufacturer's recommendations for sign sizes indicated, as approved.

The contractor shall exercise caution during any excavation in the work so as not to damage any existing utilities whether shown or not shown on the plans. Any utilities which are disturbed or damaged during construction shall be repaired or replaced by the Contractor at no extra cost to the department. Repairs to damaged utilities shall be subject to inspection by the Engineer prior to being covered.

3.2 FABRICATION

Fabrication of sign supports and other component parts of signs requiring fabrication shall be equal to the best general practice in modern shops. Galvanized steel components shall be hot-dip galvanized after fabrication has been completed. Abraded or damaged surfaces shall be regalvanized or painted with two (2) coats of commercially available zinc rich paint.

Sign structures shall be constructed to required dimensions; shall be free from kinks, twists, or bends; and shall be uniform in appearance. Completed sections shall be assembled in the shop and shall be checked for straightness, alignment, and dimensions. Any irregularities shall be corrected.

3.3 SIGN POSTS AND SUPPORTS

All sign posts and supports, except for bridge mounted signs, shall be driven or mounted plumb. Posts that are driven may be driven byhand or mechanical devices. Posts shall be protected, during driving, by use of a driving cap. Sections that are damaged or otherwise not acceptable shall be removed and replaced at the contractor's expense.

3.4 MOUNTING SIGNS

Sign panels shall be installed on posts as shown. Any chipping or bending of sign panels shall be considered as sufficient cause to require replacement of panels at the contractor's expense.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02935

TURF

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING
 - 1.3.1 Delivery
 - 1.3.1.1 Soil Amendments
 - 1.3.2 Inspection
 - 1.3.3 Storage
 - 1.3.4 Limits of Seeding

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Seed
 - 2.1.1.1 Seed Classification
 - 2.1.1.2 Seed Mixtures
 - 2.1.1.3 Quality
 - 2.1.1.4 Temporary Seed
 - 2.1.1.5 Seed Mixing
 - 2.1.2 Sod
 - 2.1.2.1 Soil Amendments
 - 2.1.2.2 Lime
 - 2.1.3 Fertilizer
 - 2.1.3.1 Organic Soil Amendments
 - 2.1.4 Mulch
 - 2.1.4.1 Straw
 - 2.1.4.2 Hay
 - 2.1.4.3 Wood Cellulose Fiber
 - 2.1.4.4 Paper Fiber Mulch
 - 2.1.5 Asphalt Adhesive
 - 2.1.5.1 Emulsified Asphalt
 - 2.1.5.2 Cutback Asphalt
 - 2.1.6 Water
 - 2.1.7 Pesticide
 - 2.1.8 Erosion Control Material
 - 2.1.8.1 Soil Erosion Control Blanket
 - 2.1.8.2 Soil Erosion Control Fabric
 - 2.1.8.3 Soil Erosion Control Net
 - 2.1.8.4 Soil Erosion Control Chemicals
 - 2.1.8.5 Hydrophilic Colloids
 - 2.1.8.6 Anchors

PART 3 EXECUTION

- 3.1 SEEDING, SODDING AND SPRIGGING TIMES AND CONDITIONS

- 3.1.1 Seeding Time
- 3.1.1 Turfing Conditions
- 3.2 SITE PREPARATION
 - 3.2.1 Grading
 - 3.2.2 Application of Soil Amendments
 - 3.2.2.1 Lime
 - 3.2.2.3 Fertilizer
 - 3.2.3 Tillage
 - 3.2.3.1 Minimum Depth
 - 3.2.4 Finished Grading
 - 3.2.4.1 Preparation
 - 3.2.4.2 Lawn Area Debris
 - 3.2.4.3 Field Area Debris
 - 3.2.4.4 Protection
- 3.3 SEEDING
- 3.3 General
- 3.4 Equipment Calibration
- 3.5 Applying Seed
 - 3.3.3.1 Broadcast Seeding
- 3.5.1 Rolling
- 3.6 Hydroseeding
- 3.7 Mulch
 - 3.7.1 Straw or Hay Mulch
 - 3.7.2 Mechanically Anchoring
 - 3.7.3 Asphalt Adhesive Tackifier
 - 3.7.4 Non-Asphaltic Tackifier
 - 3.7.5 Spreading Asphalt Adhesive Coated Mulch
 - 3.7.6 Wood Cellulose Fiber
 - 3.3.6 Water
- 3.8 EROSION CONTROL
 - 3.8.1 Erosion Control Material
 - 3.8.2 Temporary Turf Cover
 - 3.8.2.1 General
 - 3.8.2.2 Application
- 3.9 APPLICATION OF PESTICIDE
- 3.10 RESTORATION AND CLEAN UP
 - 3.10.1 Restoration
 - 3.10.2 Clean Up
- 3.11 PROTECTION OF TURFED AREAS
- 3.12 TURF ESTABLISHMENT PERIOD
 - 3.12.1 Commencement
 - 3.10.2 Satisfactory Stand of Turf
 - 3.10.2.1 Seeded Area
 - 3.10.3 Maintenance During Establishment Period
 - 3.12.2 General
 - 3.12.3 Mowing
 - 3.10.3.3 Watering
 - 3.12.4 Pesticide
 - 3.10.3.6 Repair
- 3.13 FINAL ACCEPTANCE
 - 3.13.1 Preliminary Inspection
 - 3.13.2 Final Inspection

-- End of Section Table of Contents --

SECTION 02935

TURF

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Amended thru: Aug 1988) Federal Seed Act Regulations (Part 201-202)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 977 (1991) Emulsified Asphalt

ASTM D 2028 (1976; R 1992) Cutback Asphalt (Rapid-Curing Type)

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909 (Basic; Notice 1) Fertilizer

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Manufacturer's Literature; FIO.

Manufacturer's literature discussing physical characteristics, application and installation instructions for erosion control material, and for chemical treatment material.

SD-07 Schedules

Equipment List; FIO.

A list of proposed pesticide application, seeding and mulching equipment to be used in performance of turfing operation, including descriptive data and calibration tests.

SD-08 Statements

Delivery; FIO.

Delivery schedule, at least 10 days prior to the intended date of the first delivery.

Application of Pesticide; GA.

Pesticide treatment plan with proposed sequence of pesticide treatment work. The pesticide trade name, chemical composition, formulation, concentration, application rate of active ingredients and method of application for all materials; and the name and state license number of the state certified applicator shall be included.

Turf Establishment Period; FIO.

Written calendar time period for the turf establishment period. When there is more than one turf establishment period, the boundaries of the turfed area covered for each period shall be described.

SD-13 Certificates

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Certified copies of the reports for the following materials shall be included:

Seed; GA.

For mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested and state certification.

Fertilizer; GA.

For chemical analysis, composition percent.

Agricultural Limestone; FIO.

For calcium carbonate equivalent and sieve analysis.

Asphalt Adhesive; FIO.

For compliance with ASTM D 977 and ASTM D 2028.

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Delivery

1.3.1.1 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.3.2 Inspection

Seed shall be inspected upon arrival at the job site by the Contracting Officer for conformity to type and quality in accordance with paragraph MATERIALS. Other materials shall be inspected for meeting specified requirements and unacceptable materials shall be removed from the job site.

1.3.3 Storage

Seed, lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials.

1.3.4 Limits of Seeding

All areas where ground cover has been removed, damaged or destroyed within the range area and borrow areas and any nonsurfaced areas disturbed by the contractor shall be appropriately prepared and seeded. Additional turf establishment for erosion control in accordance with provisions of Section 02130 KDPS PERMIT FOR CONSTRUCTION is also included.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Seed

2.1.1.1 Seed Classification

State-approved seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.1.1.2 Seed Mixtures

Seed mixtures shall be proportioned by weight as follows:

For fall planting use:

| <u>Name</u> | <u>Mixture Percent by Weight</u> |
|---------------|--------------------------------------|
| Orchard Grass | 28 |
| Deer Tongue | 28 |
| Alsike Clover | 30 |
| Annual Rye | 14 |

For spring or summer planting use:

| <u>Name</u> | <u>Mixture Percent by Weight</u> |
|---------------------|--------------------------------------|
| Big Bluestem | 18 |
| Little Bluestem | 32 |
| Eastern Gamma Grass | 18 |
| Switchgrass | 18 |
| Annual Rye | 14 |

Cut areas exposing shale material may be seeded with Crown Velen at the rate specified.

2.1.1.3 Quality

Weed seed shall not exceed 1 percent by weight of the total mixture. Wet,

moldy, or otherwise damaged seed shall be rejected.

2.1.1.4 Temporary Seed

The temporary seed for erosion control shall be as follows:

| <u>Name</u> | <u>Live Seed</u> | <u>Period</u> |
|------------------|------------------|-------------------|
| Rye Grain | 80% | Sept. 1 - Nov. 30 |
| Annual Rye Grass | 85% | Mar. 1 - Aug. 31 |

2.1.1.5 Seed Mixing

The field mixing of seed shall be performed on site in the presence of the Contracting Officer.

2.1.2 Sod

2.1.2.1 Soil Amendments

Soil amendments shall consist of lime, fertilizer, organic soil amendments and soil conditioners meeting the following requirements.

2.1.2.2 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.1.3 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909. Granular Fertilizer: Consists of nitrogen-phosphorus-potassium ratio: 8 percent nitrogen 16 percent phosphorus, and 16 percent potassium.

2.1.3.1 Organic Soil Amendments

Topsoil: The existing surface soil shall be stripped and stockpiled on the site in accordance with Section 02221EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

2.1.4 Mulch

Mulch shall be free from weeds, mold, and other deleterious materials.

2.1.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

2.1.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other

herbaceous mowings furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

2.1.4.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate visual metering during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.1.4.4 Paper Fiber Mulch

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

2.1.5 Asphalt Adhesive

Asphalt adhesive shall conform to the following:

2.1.5.1 Emulsified Asphalt

Conforming to ASTM D 977, Grade SS-1.

2.1.5.2 Cutback Asphalt

Conforming to ASTM D 2028, designation RC-70.

2.1.6 Water

Water shall not contain elements toxic to plant life.

2.1.7 Pesticide

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide and miticide. For the purpose of this specification, soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved insecticide, fungicide, nematocide, rodenticide, miticide, and soil fumigant.

2.1.8 Erosion Control Material

Soil erosion control shall conform to the following:

2.1.8.1 Soil Erosion Control Blanket

Machine produced mat of wood excelsior formed from a web of interlocking wood fibers, covered on one side with either knitted straw blanket-like mat construction, covered with biodegradable plastic mesh, or interwoven biodegradable thread, plastic netting or twisted kraft paper cord netting.

2.1.8.2 Soil Erosion Control Fabric

Knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall last 6 to 8 months.

2.1.8.3 Soil Erosion Control Net

Heavy, twisted jute mesh weighing approximately 1.22 pounds per linear yard

and 4 feet wide with mesh openings of approximately 1 inch square.

2.1.8.4 Soil Erosion Control Chemicals

High-polymer synthetic resin or cold-water emulsion of selected petroleum resins.

2.1.8.5 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life, without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids must resist mold growth.

2.1.8.6 Anchors

Erosion control anchor material shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 SEEDING, SODDING AND SPRIGGING TIMES AND CONDITIONS

3.1.1 Seeding Time

Seed shall be sown from March 15 to May 15 for spring and summer planting and from August 15 to October 15 for fall planting.

3.1.1 Turfing Conditions

Turf operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed.

When special conditions warrant a variance to the turf operations, proposed times shall be submitted to and approved by the Contracting Officer.

3.2 SITE PREPARATION

3.2.1 Grading

The Contracting Officer shall verify that finished grades are as indicated on drawings, and the placing of topsoil and the smooth grading has been completed in accordance with Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

3.2.2 Application of Soil Amendments

3.2.2.1 Lime

Lime shall be applied at the rate of 3 tons per acre. Lime shall be incorporated into the soil to a minimum depth of 4 inches or may be incorporated as part of the tillage operation.

3.2.2.3 Fertilizer

Fertilizer shall be applied at the rate of 1,000 pounds per acre. Fertilizer shall be incorporated into the soil to a minimum depth of 4 inches and may be incorporated as part of the tillage or hydroseeding operation.

3.2.3 Tillage

3.2.3.1 Minimum Depth

Soil on slopes gentler than 3-horizontal-to-1-vertical shall be tilled to a minimum depth of 4 inches. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum depth of 2 inches by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required.

3.2.4 Finished Grading

3.2.4.1 Preparation

Turf areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Turf areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS and 02225 EARTHWORK FOR ROADWAYS, TRAILS, TARGETS, AND BERMS. Finished grade shall be 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

3.2.4.2 Lawn Area Debris

Lawn areas shall have debris and stones larger than 1 inch in any dimension removed from the surface.

3.2.4.3 Field Area Debris

Field areas shall have debris and stones larger than 3 inches in any dimension removed from the surface.

3.2.4.4 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.3 SEEDING

3.3 General

Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution. All areas disturbed by contractors operations shall be seeded.

3.4 Equipment Calibration

The equipment to be used and the methods of turfing shall be subject to the inspection and approval of the Contracting Officer prior to commencement of turfing operations. Immediately prior to the commencement of turfing operations, the Contractor shall conduct turfing equipment calibration tests in the presence of the Contracting Officer.

3.5 Applying Seed

3.3.3.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate of 73 pounds per acre using broadcast seeders. Half of seed shall be broadcast in one direction, and the remainder at right angles to the first direction. Seed shall be covered to an average depth of 1/4-inch by disk harrow, steel mat drag, cultipacker, or other approved device.

3.5.1 Rolling

Immediately after seeding, except for slopes 3-horizontal-to-1 vertical and greater, the entire area shall be firmed with a roller not exceeding 90 pounds for each foot of roller width.

3.6 Hydroseeding

Seed and fertilizer shall be added to water and thoroughly mixed at the rates specified. Wood cellulose fiber mulch shall be added at the rates recommended by the manufacturer after the seed, fertilizer and water have been thoroughly mixed, to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

3.7 Mulch

3.7.1 Straw or Hay Mulch

Straw or hay mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of a steep slope and continued uniformly until the area is covered. The mulch shall not be bunched. All seeded areas shall be mulched on the same day as the seeding.

3.7.2 Mechanically Anchoring

Immediately following spreading, the mulch shall be anchored to the soil by a V-type-wheel land packer, a scalloped-disk land packer designed to force mulch into the soil surface, or other suitable equipment.

3.7.3 Asphalt Adhesive Tackifier

When asphalt adhesive is applied to the in-place mulch, spraying shall be at the rate of between 200 gallons per 1,000 acre.

3.7.4 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at rate recommended by manufacturer. Apply with hydraulic equipment suitable for mixing and applying uniform mixture of tackifier.

3.7.5 Spreading Asphalt Adhesive Coated Mulch

Straw or hay mulch shall be spread simultaneously with asphalt adhesive at the rate of 2 tons per acre by using power mulch equipment which shall be equipped with suitable asphalt pump and nozzle. The adhesive-coated mulch

shall be applied evenly over the surface. Sunlight shall not be completely excluded from penetration to the ground surface.

3.7.6 Wood Cellulose Fiber

Wood cellulose fiber mulch for use with the hydraulic application of seed and fertilizer shall be applied as part of the hydroseeding operation.

3.3.6 Water

Watering shall be started within 7 days after completing the seeded area. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 1 inch. Run-off and puddling shall be prevented.

3.8 EROSION CONTROL

3.8.1 Erosion Control Material

Erosion control material, where indicated or required, shall be installed in accordance with manufacturer's instructions. Placement of the erosion control material shall be accomplished without damage to installed material or without deviation to finished grade.

3.8.2 Temporary Turf Cover

3.8.2.1 General

When there are contract delays in the turfing operation or a quick cover is required to prevent erosion, the areas designated for turf shall be seeded with a temporary seed as directed by the Contracting Officer. The temporary seed shall be:

| <u>NAME</u> | <u>LIVE SEED</u> | <u>PERIOD</u> |
|-------------|------------------|-------------------|
| Rye Grain | 80% | Sept. 1 - Nov. 30 |
| Annual Rye | 85% | Mar. 1 - Aug. 31 |

3.8.2.2 Application

When no other turfing materials have been applied, the quantity of one half of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. Seed shall be uniformly broadcast and applied at the rate of 2.54 pounds per 1,000 square feet for regrass and 0.8 pounds per 1,000 square feet for rye grass. The area shall be watered as required.

3.9 APPLICATION OF PESTICIDE

When pesticide becomes necessary to remove a pest or disease, a state-certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide plan shall be provided to the Contracting Officer as stated in paragraph SUBMITTALS.

3.10 RESTORATION AND CLEAN UP

3.10.1 Restoration

Existing turf areas, pavements and facilities that have been damaged from the turfing operation shall be restored to original condition at Contractor's expense.

3.10.2 Clean Up

Excess and waste material shall be removed from the planting operation and shall be disposed of off the site. Adjacent paved areas shall be cleaned.

3.11 PROTECTION OF TURFED AREAS

Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed by the Contracting Officer.

3.12 TURF ESTABLISHMENT PERIOD

3.12.1 Commencement

The Turf Establishment Period for establishing a healthy stand of turf shall begin on the first day of work under this contract and shall end three (3) months after the last day of turfing operations required by this contract. Written calendar time period shall be furnished to the Contracting Officer for the Turf Establishment Period. When there is more than one turf establishment period, describe the boundaries of the turfed area covered for each period.

3.10.2 Satisfactory Stand of Turf

3.10.2.1 Seeded Area

- a. Field Area: A satisfactory stand of turf from the seeding operation for a field area is defined as a minimum of 10 grass plants per square foot. The total bare spots shall not exceed 2 percent of the total seeded area.

3.10.3 Maintenance During Establishment Period

3.12.2 General

Maintenance of the turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turfed areas from traffic, mowing, watering, and post-fertilization.

3.12.3 Mowing

- a. Roadway Shoulder Areas: Roadway shoulder areas shall be mowed to a minimum height of 2 inches when the average height of the turf becomes 6 inches. Clippings shall be removed when the amount of cut turf is heavy enough to damage the turfed areas.
- b. Field Areas: Field areas shall be mowed once during the season to a minimum height of 4 inches.

3.10.3.3 Watering

Watering shall be at intervals to obtain a moist soil condition to a

minimum depth of 1 inch. Frequency of watering and quantity of water shall be adjusted in accordance with the growth of the turf. Run-off, puddling and wilting shall be prevented.

3.12.4 Pesticide

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.10.3.6 Repair

The Contractor shall re-establish as specified herein, eroded, damaged or barren areas. Mulch shall also be repaired or replaced as required.

3.13 FINAL ACCEPTANCE

3.13.1 Preliminary Inspection

Prior to the completion of the Turf Establishment Period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The acceptability of the turf in accordance with the Turf Establishment Period shall be determined. An unacceptable stand of turf shall be repaired as soon as turfing conditions permit.

3.13.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02950

TREES, SHRUBS, GROUND COVERS, AND VINES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SOURCE INSPECTIONS
 - 1.3.1 Plant Materials
 - 1.3.2 Delivered Topsoil
- 1.4 SHIPMENT, DELIVERY, INSPECTION, STORAGE, AND HANDLING
 - 1.4.1 Shipment
 - 1.4.1.1 Preparation
 - 1.4.2 Delivery
 - 1.4.2.1 Identification
 - 1.4.2.2 Protection During Delivery
 - 1.4.2.3 Topsoil
 - 1.4.2.4 Soil Amendments
 - 1.4.2.5 Pesticide
 - 1.4.3 Inspection
 - 1.4.4 Storage
 - 1.4.4.1 Plant Storage
 - 1.4.4.2 Storage of Other Materials
 - 1.4.5 Handling
 - 1.4.5.1 Time Limitation
- 1.5 WARRANTY

PART 2 PRODUCTS

- 2.1 PLANTS
 - 2.1.1 Varieties
 - 2.1.2 Substitutions
 - 2.1.3 Growing Conditions
 - 2.1.4 Quality
 - 2.1.4.1 Shade and Flowering Trees
 - 2.1.4.2 Deciduous Shrub
 - 2.1.4.3 Coniferous Evergreen
 - 2.1.4.4 Broadleaf Evergreen
 - 2.1.4.5 Groundcovers and Vines
 - 2.1.5 Size
 - 2.1.6 Measurement
- 2.2 TOPSOIL
- 2.3 SOIL AMENDMENTS
 - 2.3.1 Lime
 - 2.3.2 Fertilizer
 - 2.3.2.1 Dry Fertilizer
 - 2.3.3 Bonemeal
 - 2.3.4 Organic Soil Amendments
 - 2.3.4.1 Peat

- 2.3.4.2 Sand
- 2.3.4.3 Rotted Manure
- 2.3.4.4 Decomposed Wood Derivatives
- 2.3.5 Soil Conditioner
 - 2.3.5.1 Gypsum
 - 2.3.5.2 Aluminum Sulfate
- 2.4 MULCH
 - 2.4.1 Inert Mulch Material
 - 2.4.2 Organic Mulch Material
- 2.5 GEOTEXTILE
 - 2.5.1 Woven Polypropylene
 - 2.5.2 Nonwoven Polypropylene
 - 2.5.3 Nonwoven polyester
 - 2.5.4 Fiberglass Mat
- 2.6 TRUNK WRAPPING MATERIAL
- 2.7 GUYING AND STAKING MATERIAL
 - 2.7.1 Stakes
 - 2.7.1.1 Bracing Stakes
 - 2.7.1.2 Ground Stakes
 - 2.7.2 Guying Material
 - 2.7.2.1 Guying Wire
 - 2.7.2.2 Guying Cable
 - 2.7.3 Chafing Guard
 - 2.7.4 Flags
 - 2.7.5 Turnbuckles
- 2.8 EDGING MATERIAL
 - 2.8.1 Steel
 - 2.8.2 Plastic
 - 2.8.3 Anchors
- 2.9 WATER
- 2.10 ANTIDESICCANT
- 2.11 EROSION CONTROL MATERIAL
 - 2.11.1 Soil Erosion Control Blanket
 - 2.11.2 Soil Erosion Control Fabric
 - 2.11.3 Soil Erosion Control Net
 - 2.11.4 Anchors
- 2.12 TREE WOUND DRESSING
- 2.13 PESTICIDE

PART 3 EXECUTION

- 3.1 EXAMINATION
 - 3.1.1 Verify Grades
 - 3.1.2 Underground Obstructions to Planting
- 3.2 SITE PREPARATION
 - 3.2.1 Layout
 - 3.2.2 Protection of Existing Vegetation
- 3.3 EXCAVATION
 - 3.3.1 Obstructions Below Ground or Poor Drainage
 - 3.3.2 Turf Removal
 - 3.3.3 Plant Pits
- 3.4 PLANTING TIMES AND CONDITIONS
 - 3.4.1 Deciduous Planting Time
 - 3.4.2 Evergreen Planting Time
 - 3.4.3 Existing Plant Transplanting Time
 - 3.4.4 Planting Conditions
- 3.5 INSTALLATION
 - 3.5.1 Erosion Control
 - 3.5.2 Setting Plants

- 3.5.3 Controlled-Release Fertilizer
- 3.5.4 Balled and Burlapped Plants
- 3.5.5 Bare-Root Plants
- 3.5.6 Container-Grown, Balled and Platformed and Balled and Potted Plants
- 3.5.7 Groundcover Bed
 - 3.5.7.1 Plant Beds in Existing Soil
 - 3.5.7.2 Plant Beds in Replaced Soil
 - 3.5.7.3 Groundcover
- 3.5.8 Transplanting Existing Plants
- 3.5.9 Staking and Guying
 - 3.5.9.1 One Bracing Stake
 - 3.5.9.2 Two Bracing Stakes
 - 3.5.9.3 Three Guying Wires
- 3.5.10 Flags
- 3.5.11 Edging Material
- 3.6 FINISHING
 - 3.6.1 Plant Beds
 - 3.6.2 Pruning
 - 3.6.3 Mulch
 - 3.6.4 Geotextile
 - 3.6.5 Trunk Wrap
 - 3.6.6 Water
- 3.7 MAINTENANCE DURING PLANTING OPERATION
- 3.8 CARE OF EXISTING PLANT MATERIAL
 - 3.8.1 Identification
 - 3.8.2 Fertilizing Existing Trees
 - 3.8.2.1 Dry Fertilizer
 - 3.8.2.2 Application
 - 3.8.2.3 Backfill
 - 3.8.3 Pruning and Cavity Work
- 3.9 APPLICATION OF PESTICIDE MATERIAL
- 3.10 RESTORATION AND CLEAN UP
 - 3.10.1 Restoration
 - 3.10.2 Clean Up
- 3.11 PLANT ESTABLISHMENT PERIOD
 - 3.11.1 Commencement
 - 3.11.2 Maintenance During Establishment Period
 - 3.11.2.1 General
 - 3.11.2.2 Water
 - 3.11.2.3 Weeding
 - 3.11.2.4 Unhealthy Plants
 - 3.11.2.5 Fertilizing
 - 3.11.2.6 Settlement
 - 3.11.2.7 Pesticide Treatment
 - 3.11.2.8 Maintenance Report
 - 3.11.2.9 Maintenance Instructions
 - 3.11.3 Replacement Plants
- 3.12 FINAL ACCEPTANCE
 - 3.12.1 Preliminary Inspection
 - 3.12.2 Final Inspection

-- End of Section Table of Contents --

SECTION 02950

TREES, SHRUBS, GROUND COVERS, AND VINES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)

AAN-01 (1990) American Standard for Nursery Stock

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2607 (1969) Peats, Mosses, Humus, and Related Products

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909 (Basic; Notice 1) Fertilizer

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Edging Material; FIO.

Manufacturer's literature discussing physical characteristics, application and installation instructions for edging material.

SD-13 Certificates

Topsoil; GA. Soil Amendments; GA. Plants; GA. Pesticide; GA.

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Reports for the following materials shall be included.

- a. Topsoil: For pH, chemical analysis, mechanical analysis and particle size.
- b. Fertilizer: For chemical analysis and composition percent.
- c. Agricultural Limestone: For sieve analysis and calcium carbonate

equivalent.

- d. Peat: For compliance with ASTM D 2607.
- e. Plant Materials: For botanical and common name, size, quantity by species, grade, nursery grown.
- f. Pesticide Material: For EPA registration number and registered uses.

SD-18 Records

Plant Establishment Period; FIO. Maintenance Report; FIO. Maintenance Instructions; FIO.

- a. Maintenance Report. Written record of maintenance work performed and quantity of plant losses and replacements.
- b. Plant Establishment Period. Written calendar time period for the beginning of the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.
- c. Maintenance Instruction. Written instructions for year-round care of installed plants.

1.3 SOURCE INSPECTIONS

1.3.1 Plant Materials

Plant materials shall be subject to inspection at the growing site by the Contracting Officer.

1.3.2 Delivered Topsoil

The source of topsoil shall be subject to inspection by the Contracting Officer.

1.4 SHIPMENT, DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Shipment

1.4.1.1 Preparation

Digging and preparation for shipment shall be done in a manner that will not cause shock or damage to branches, trunk, or root systems.

- a. Balled and Burlapped (BB) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. Center the plant stem or trunk in the ball and clean cut all roots at the ball surface. No roots shall be pulled from the ground. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with twine.
- b. Balled and Potted (Pot) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a

diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball and all roots shall be clean cut at the ball surface. No roots shall be pulled from the ground. Containers shall be used to retain the ball unbroken. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

- c. Balled and Platform (BP) Plants: Ball size and ratio shall be provided as recommended by AAN-01. Plants shall be prepared as BB plants and securely fastened to wood platform for shipping.
- d. Bare-Root (BR) Plants: Minimum root spread shall be as recommended by AAN-01. A well branched root system characteristic of the variety specified shall be provided. No roots shall be pulled from the ground. The root system shall be protected from drying out.
- e. Container-Grown (C) Plants: Container size shall be provided as recommended by AAN-01. Plants shall be grown in a container sufficiently long for new fibrous roots to have developed and for root mass to retain its shape and hold together when removed from container. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

1.4.2 Delivery

1.4.2.1 Identification

Plants shall be identified with durable waterproof labels and weather-resistant ink. Plants shall have attached labels stating the correct plant name and size.

1.4.2.2 Protection During Delivery

Plants shall be protected during delivery to prevent desiccation of the plant or damage to the roots or balls. Branches of plants shall be protected by tying-in the branches and covering all exposed branches.

1.4.2.3 Topsoil

A soil test shall be provided for topsoil delivered to the site.

1.4.2.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.2.5 Pesticide

Pesticide materials shall be delivered to the site in the original unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration numbers and the registered uses.

1.4.3 Inspection

Plant material shall be inspected upon arrival at the jobsite by the Contracting Officer for conformity to the paragraph PLANTS and paragraph Shipment, and any unacceptable plant material shall be removed from the jobsite.

1.4.4 Storage

1.4.4.1 Plant Storage

Plants not installed on the day of arrival at the site shall be stored and protected in areas designated by the Contracting Officer. Plants shall be protected from exposure to wind and shall be shaded from the sun. Covering that will allow air to circulate and prevent internal heat from building up shall be provided. Bare-root plants shall be heeled-in. All plants shall be kept in a moist condition by watering with a fine mist spray until planted.

1.4.4.2 Storage of Other Materials

Soil amendments shall be stored in dry locations away from contaminants. Pesticide materials shall not be stored with other landscape materials. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

1.4.5 Handling

Care shall be taken to avoid injury to plants. Materials shall not be dropped from vehicles. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball and container-grown plants shall be handled by the container. Plants shall not be handled by the trunk or stems.

1.4.5.1 Time Limitation

- a. Mulch: Limitation of time between installing plant and placing mulch is 48 hours.
- b. Trunk Wrap: Limitation of time between installing deciduous trees and wrapping the trunks is 24 hours.
- c. Transplanting Existing Plants: Limitation of time between digging and replanting existing plant material is one hour.

1.5 WARRANTY

Furnished plants shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanted existing plants require no guarantee. A written calendar time period for the guarantee of plant growth shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Varieties

Plants shall be nursery grown or plantation grown stock conforming to AAN-01 and shall be of the varieties specified in the plant list bearing

botanical names listed in one or more of the publications listed under "Nomenclature" in AAN-01.

2.1.2 Substitutions

Substitutions will not be permitted without written request from the Contractor for approval by the Contracting Officer.

2.1.3 Growing Conditions

Plants shall be grown under climatic conditions similar to those in the locality of the project.

2.1.4 Quality

Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plants shall be provided that are typical of the species or variety and conforming to standards as set forth in AAN-01 and as specified herein.

2.1.4.1 Shade and Flowering Trees

A height relationship to caliper shall be provided as recommended by AAN-01.

Height of branching should bear a relationship to the size and variety of tree specified and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

- a. Single stem: Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than 6 inches from ground level.
- c. Specimen: A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.4.2 Deciduous Shrub

Plants shall be provided that have the height and number of primary stems as recommended by AAN-01. An acceptable plant shall be well shaped with sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

2.1.4.3 Coniferous Evergreen

Trees shall be provided that have the height-to-spread ratio as recommended by AAN-01. Trees shall not be "poled" or the leader removed. An acceptable plant shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

2.1.4.4 Broadleaf Evergreen

Plants shall be provided that have ratio of height-to-spread as recommended by AAN-01. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

2.1.4.5 Groundcovers and Vines

Plants shall be provided with the minimum number of runners and length of runner as recommended by AAN-01. Plants shall be furnished that have heavy, well developed and balanced top with vigorous well developed root system and shall be furnished in containers.

2.1.5 Size

Plants shall be furnished in sizes indicated. Plants larger in size than specified may be provided at no additional cost to the Government.

2.1.6 Measurement

Plant measurements shall be in accordance with AAN-01.

2.2 TOPSOIL

Topsoil shall be the existing surface soil stripped to the depth indicated and stockpiled on the site in accordance with Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS. Additional topsoil, if required, beyond that available from stripping operations, shall be delivered. Delivered topsoil shall conform to topsoil requirement specified in Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS and shall be amended as recommended by soil tests for the plants specified.

2.3 SOIL AMENDMENTS

Soil amendments consist of lime, fertilizer, bonemeal, organic soil amendments and soil conditioner.

2.3.1 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.3.2 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909.

2.3.2.1 Dry Fertilizer

- a. Granular fertilizer : Consists of nitrogen-phosphorous-potassium ratio: 13 percent nitrogen 13 percent phosphorous, and 13 percent potassium.
- b. Controlled-Release Fertilizer: Consists of nitrogen-phosphorous-potassium ratio: 13 percent nitrogen 13 percent phosphorous, and 13 percent potassium. Controlled-release fertilizer may be in packet or tablet form.

2.3.3 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.4 Organic Soil Amendments

2.3.4.1 Peat

Peat shall be a natural product of hypnum moss peat derived from a bog, swampland or marsh and shall conform to ASTM D 2607.

2.3.4.2 Sand

Sand shall be clean and free of toxic materials and at least 95 percent by weight shall pass a 10-mesh sieve, and 10 percent by weight shall pass a 16-mesh sieve.

2.3.4.3 Rotted Manure

Rotted manure shall be unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

2.3.4.4 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants and stabilized with nitrogen and having the following properties:

| Particle size | Minimum percent by weight passing |
|-------------------|-------------------------------------|
| No. 4 mesh screen | 95 |
| No. 8 mesh screen | 80 |
| Nitrogen Content | Minimum percent based on dry weight |
| Redwood Sawdust | 0.5 |
| Fir Sawdust | 0.7 |
| Fir or Pine Bark | 1.0 |

2.3.5 Soil Conditioner

For single use or in combination to meet requirements for topsoil.

2.3.5.1 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum of 95 percent calcium sulfate by volume.

2.3.5.2 Aluminum Sulfate

Aluminum sulfate shall be commercial grade.

2.4 MULCH

Mulch shall be free from weeds, mold and other deleterious materials.

2.4.1 Inert Mulch Material

Inert mulch materials shall be riverbank stone, and shall range in size from 1/2" to 3/4".

2.4.2 Organic Mulch Material

Organic mulch materials shall be pine needle, pecan shells, ground or shredded bark ranging in size from 1/2" to 3/4".

2.5 GEOTEXTILE

2.5.1 Woven Polypropylene

Woven polypropylene shall be bi-directional, weigh a minimum 4 ounces per square yard, be a minimum 10 mils thick and come in 6 feet wide rolls.

2.5.2 Nonwoven Polypropylene

Nonwoven polypropylene shall be spunbonded, water permeable, non-brittle, weigh a minimum 4 ounces per square yard, be a minimum 10 mils thick and come in 6 feet wide rolls.

2.5.3 Nonwoven polyester

Nonwoven polyester shall be spunbonded, water permeable, non-brittle, weigh a minimum 4 ounces per square yard, be a minimum 10 mils thick and come in 6 feet wide rolls.

2.5.4 Fiberglass Mat

Fiberglass mat shall be of lime borosilicate glass fibers with an average fiber diameter of 8 to 12 microns and 2 to 4 inch strands of fiber bonded with phenol formaldehyde resin. The mat shall be 100 percent textile glass fiber. Mat shall be roll type, water permeable, and a minimum of 1/4-inch and a maximum of 1/2-inch thick with a density of not less than 3/4 pound per cubic foot.

2.6 TRUNK WRAPPING MATERIAL

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and have a stretch factor of 33-1/3 percent. Twine for tying shall be lightly tarred medium or coarse sisal yarn.

2.7 GUYING AND STAKING MATERIAL

2.7.1 Stakes

Stakes for tree support shall be rough sawn wood, free from knots, rot, cross grain, or other defects that would impair the strength. Standard stakes shall be hardwood or fir treated with pentachlorophenol.

2.7.1.1 Bracing Stakes

Bracing stakes shall be a minimum of 2 inches by 2 inches or 2-1/2 inches in diameter by 8 feet long and pointed at one end.

2.7.1.2 Ground Stakes

Ground stakes shall be a minimum of 2 inches by 2 inches or 2-1/2 inches in diameter by 3 feet long and pointed at one end.

2.7.2 Guying Material

2.7.2.1 Guying Wire

Guying wire shall be 12-gauge annealed galvanized steel wire.

2.7.2.2 Guying Cable

Guying cable shall be a minimum of five-strand, 3/16-inch diameter cadmium plated steel cable.

2.7.3 Chafing Guard

Hose chafing guards shall be new or used 2-ply reinforced rubber or plastic hose and shall be all the same color on the project. Length shall be 1-1/2 times the circumference of the plant at its base.

2.7.4 Flags

Flags to be fastened to guys shall be white surveyor's plastic tape, 6 inches in length.

2.7.5 Turnbuckles

Turnbuckles shall be galvanized or cadmium-plated steel and have a 3-inch minimum lengthwise opening fitted with screw eyes.

2.8 EDGING MATERIAL

2.8.1 Steel

Steel edging shall be galvanized with slots provided for stakes and shall be at least 1/8 inch thick and 4 inches wide, and supplied in at least 16-foot lengths.

2.8.2 Plastic

Plastic edging shall be 4-5/8 inches deep by 5/32 inch thick in 20 foot lengths.

2.8.3 Anchors

Edging material anchors shall be as recommended by the manufacturer.

2.9 WATER

Water shall not contain elements toxic to plant life.

2.10 ANTIDESICCANT

Antidesiccant shall be an emulsion that will provide a film over plant

surfaces permeable enough to permit transpiration, and shall not damage the plant.

2.11 EROSION CONTROL MATERIAL

2.11.1 Soil Erosion Control Blanket

Blanket shall be machine-produced mat of wood excelsior formed from a web of interlocking wood fibers, covered on one side with either knitted straw blanket-like mat-construction, covered with biodegradable plastic mesh, or interwoven with biodegradable thread, plastic netting or twisted kraft paper cord netting.

2.11.2 Soil Erosion Control Fabric

Control fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall last 6 to 8 months.

2.11.3 Soil Erosion Control Net

Control net shall be heavy, twisted jute mesh weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings of approximately 1 inchsquare.

2.11.4 Anchors

Erosion control anchors shall be as recommended by the manufacturer.

2.12 TREE WOUND DRESSING

Tree wound dressing shall be a black paint consisting of Bordeaux Mixture, raw linseed oil, and lamp black.

2.13 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide, and miticide. Pesticide material shall be labeled for use and applied only as registered by EPA and approved herbicide and insecticide.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verify Grades

The Contracting Officer shall verify the finished grades are as indicated on drawings, and the placing of topsoil and smooth grading has been completed in accordance with Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.1.2 Underground Obstructions to Planting

The location of underground utilities and facilities shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2 SITE PREPARATION

3.2.1 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted by the Contracting Officer to meet field conditions.

3.2.2 Protection of Existing Vegetation

If lawns have been established prior to planting operations, the surrounding turf shall be covered before excavations are made in a manner that will protect turf areas. Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner that will effectively protect them during planting operations.

3.3 EXCAVATION

3.3.1 Obstructions Below Ground or Poor Drainage

When obstructions below ground or poor drainage affect the contract operation, proposed adjustments to plant location, type of plant and planting method or drainage correction shall be submitted to and approved by the Contracting Officer.

3.3.2 Turf Removal

Where planting beds occur in existing turf areas, the turf shall be removed to a depth that will ensure the removal of the entire root system.

3.3.3 Plant Pits

Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. When pits are dug with an auger and the sides of the pits become glazed, the glazed surface shall be scarified. The minimum allowable dimensions of plant pits shall be 6 inches deeper than the depth of ball or the depth of base roots; for ball or root spreads up to 2 feet, pit diameters shall be twice the root spread; for ball or root spreads from 2 to 4 feet, pit diameters shall be 2 feet greater; for ball or root spreads over 4 feet, pit diameters shall be 1-1/2 times the ball root spread.

3.4 PLANTING TIMES AND CONDITIONS

3.4.1 Deciduous Planting Time

Install deciduous plants from January to August for spring and summer planting and from August to December for fall planting.

3.4.2 Evergreen Planting Time

Install evergreen plants from January to August for spring and summer planting and from August to December for fall planting.

3.4.3 Existing Plant Transplanting Time

Existing plants shall be transplanted from January to August for spring and summer planting and from August to December for fall planting.

3.4.4 Planting Conditions

Planting operations shall be performed only during periods when beneficial

results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to and approved by the Contracting Officer.

3.5 INSTALLATION

3.5.1 Erosion Control

Where erosion control material is indicated or required, material shall be installed in accordance with manufacturer's instructions. Placement of the erosion control material shall be accomplished without damage to installed material or without deviation to finished grade.

3.5.2 Setting Plants

Plants shall be set plumb and held in position until sufficient soil has been firmly placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth at which they were grown in the nursery, or container.

3.5.3 Controlled-Release Fertilizer

Controlled-release fertilizer shall be placed in packet or tablet form in the plant pit in the immediate vicinity of the feeding roots in accordance with the manufacturer's recommendations.

3.5.4 Balled and Burlapped Plants

Balled and burlapped stock shall be backfilled with backfill soil mixture to approximately half the depth of the ball and then tamped and watered. Biodegradable burlap and tying material shall be carefully opened and folded back. The backfill shall be completed, tamped and watered. A 4-inch high earth saucer shall be formed around individual plants.

3.5.5 Bare-Root Plants

Bare-root plants shall be installed by arranging the roots in a natural position. Damaged roots shall be removed with a clean cut. Bare-root (BR) plants shall be backfilled with backfill soil mixture carefully worked in among the roots. The backfill and water shall be completed. A 4-inch high earth saucer shall be formed around individual plants.

3.5.6 Container-Grown, Balled and Platformed and Balled and Potted Plants

Non-biodegradable containers or platforms shall be removed without damage to the plant or root system. Biodegradable containers shall be split. The backfill shall be completed as specified for BB plants.

3.5.7 Groundcover Bed

3.5.7.1 Plant Beds in Existing Soil

Bed shall be tilled to a minimum depth of 6 inches where existing soil is to be used in-place. Selected soil amendments shall be spread uniformly over the bed.

The mixture shall be thoroughly incorporated into the soil to a minimum

depth of 6 inches using a roto-tiller or other method to obtain a uniform and well pulverized soil mix. All sticks, stones, roots and other objectionable materials shall be removed from the surface. The bed shall be brought to a smooth and even surface blending to existing areas.

3.5.7.2 Plant Beds in Replaced Soil

When soil replacement is required, the existing soil shall be excavated and removed to a minimum depth of 6 inches and backfill soil mixture shall be placed on previously scarified subsoil to a minimum depth of 6 inches. The bed shall be brought to a smooth and even surface blending to existing areas. Settlement shall be allowed for.

3.5.7.3 Groundcover

Groundcover may be planted after the mulch is in place. Contaminating the mulch with soil shall be avoided.

3.5.8 Transplanting Existing Plants

Existing plant material to be transplanted shall be tagged on the site and/or as indicated. Existing plants shall be removed from the ground by means of mechanical devices or other method with a ball attached, meeting the requirements of paragraph SHIPMENT.

3.5.9 Staking and Guying

3.5.9.1 One Bracing Stake

Trees 4 to 6 feet tall shall be held in place with one bracing stake. The tree shall be held firmly to the stake with a double strand of wire. A chafing guard shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.5.9.2 Two Bracing Stakes

Trees over 6 feet tall shall be held in place with two bracing stakes placed on opposite sides. The tree shall be held firmly between the stakes with a double strand of wire. Chafing guards shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.5.9.3 Three Guying Wires

Trees shall be held firmly in place with three guying lines of double strand wire spaced equidistantly around the tree. The line shall be anchored with ground stakes. The line shall be anchored to the tree at a point equal to one half its height. Chafing guards shall be used where the line contacts the tree. One turnbuckle shall be centered on each line for tree straightening purposes. Ground stakes shall be driven into firm ground outside the earth saucer and plant pit with the top of the stake flush with the ground surface.

3.5.10 Flags

A flag shall be securely fastened to each guying line to be visible by pedestrians.

3.5.11 Edging Material

Edging material shall be installed in accordance with the manufacturer's recommendations and/or as indicated.

3.6 FINISHING

3.6.1 Plant Beds

Planted areas shall be uniformly edged to provide a clear-cut division line between the planted area and the adjacent turf area and to provide a shape as indicated. The entire planted area shall be raked and smoothed while maintaining the earth saucers.

3.6.2 Pruning

The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth shall not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off." Cuts or wounds measuring a minimum 1/2 inch in diameter shall be painted with the specified tree wound dressing.

3.6.3 Mulch

Mulch shall be spread to a uniform thickness of 4 inches within 48 hours after planting. Mulch shall be kept out of the crowns of shrubs and off buildings, sidewalks and other facilities.

3.6.4 Geotextile

When required for weed control, geotextile shall be placed in accordance with the manufacturer's recommendations and/or as indicated.

3.6.5 Trunk Wrap

The trunks to deciduous trees shall be wrapped within 24 hours after planting. Trees 1-1/2 inches or greater in caliper shall be wrapped with the specified material beginning at the base and extending up to the first branches. The wrapping shall be securely tied with twine at the top and bottom and at 18-inch intervals.

3.6.6 Water

Plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. Run-off, puddling and wilting shall be prevented.

3.7 MAINTENANCE DURING PLANTING OPERATION

Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences. The maintenance includes watering, pruning, wound dressing, straightening and other necessary operations. Plant beds and earth saucers shall be kept free of weeds, grass and other undesired vegetation. Plants

shall be checked for settlement and shall be reset proper grade as necessary. Run-off, puddling and wilting shall be prevented.

3.8 CARE OF EXISTING PLANT MATERIAL

3.8.1 Identification

Existing plant material to be treated shall be tagged on the site and/or as indicated.

3.8.2 Fertilizing Existing Trees

Holes shall be dug by hand or mechanical devices, a minimum 1-1/2 inches in diameter and 18 inches deep, distributed evenly at not more than 2 feet on center throughout the outer half of the branch spread zone of each tree.

3.8.2.1 Dry Fertilizer

Dry fertilizer shall be placed in the hole to within 4 inches of the surrounding grade.

3.8.2.2 Application

Packet, tablet or wedge-form fertilizer shall be applied in accordance with manufacturer's recommendations.

3.8.2.3 Backfill

Topsoil or sand shall be used as backfill in the hole and shall be blended to the surrounding grade.

3.8.3 Pruning and Cavity Work

An arborist shall perform the required pruning and cavity work on existing plants. Dead wood larger than 1/2 inch in diameter, branches interfering with or hindering the healthy growth of plants, and diseased branches shall be removed. Cut back or remove branches as necessary to give the plants proper shape and balance. Stubs, improper cuts, and broken limbs shall be removed. Clean cuts shall be made flush with the parent trunk. Wounds larger than 1/2 inch in diameter and scars from contractor operations shall be cleaned. Cavities shall be shaped to provide drainage and decayed wood shall be removed. Exposed cambium layers shall be sealed with shellac. Cuts, wounds and cavity work shall be painted with tree wound dressing.

3.9 APPLICATION OF PESTICIDE MATERIAL

When pesticide becomes necessary to remove a disease or pest, a state-certified applicator shall apply required pesticide in accordance with State EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide treatment plan shall be provided to the Contracting Officer as specified in paragraph SUBMITTALS.

3.10 RESTORATION AND CLEAN UP

3.10.1 Restoration

Turf areas, pavements and facilities that have been damaged from the

planting operation shall be restored to original condition at the Contractor's expense.

3.10.2 Clean Up

Excess and waste material from the planting operation shall be removed and disposed of off the site. Adjacent paved areas shall be cleared.

3.11 PLANT ESTABLISHMENT PERIOD

3.11.1 Commencement

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, plant establishment periods shall be established for the work completed, as directed. Written calendar time period shall be furnished to the Contracting Officer for the beginning of the plant establishment period. When there is more than one plant establishment period, describe the boundaries of the planted area covered for each period.

3.11.2 Maintenance During Establishment Period

3.11.2.1 General

Maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrapping, protecting plant areas from erosion, maintaining erosion control material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

3.11.2.2 Water

The plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one inch of absorbed water per week delivered in the form of natural rain or augmented as required by periodic waterings. Run-off, puddling and wilting shall be prevented.

3.11.2.3 Weeding

Grass and weeds in earth saucers and plant beds shall not be allowed to reach a height of 3 inches before being completely removed, including the root growth.

3.11.2.4 Unhealthy Plants

A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

3.11.2.5 Fertilizing

The plants shall be top dressed at least once during the period of

establishment with dry fertilizer at the rate of 5 pounds per 100 square feet of plant pit or bed area or foliar feed plants with liquid fertilizer.

Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

3.11.2.6 Settlement

Topsoil shall be added to maintain grade and to maintain earth saucers. Serious settlement affecting the setting of the plant in relation to the depth at which it was grown requires replanting in accordance with paragraph INSTALLATION.

3.11.2.7 Pesticide Treatment

Treatment for diseases or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE MATERIAL.

3.11.2.8 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed, the quality of plant losses, cause for plant loss and replacements made on each site visit.

3.11.2.9 Maintenance Instructions

Written instructions shall be furnished to the Contracting Officer for year-round care of installed plants.

3.11.3 Replacement Plants

Plants shall be provided for replacement in accordance with paragraph PLANTS. Replacement plants shall be installed in accordance with paragraph INSTALLATION. No extended plant establishment period shall be required for replacement plants. A plant will be replaced in accordance with paragraph WARRANTY.

3.12 FINAL ACCEPTANCE

3.12.1 Preliminary Inspection

Prior to the plant establishment period a preliminary inspection shall be held by the Contracting Officer. Time for the inspection will be established in writing. The quantity and type of plants installed and the acceptability of the plants in accordance with the plant establishment period shall be determined.

3.12.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the planting operation is subject to the guarantee of plant growth.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DESIGN
- 1.4 STORAGE AND HANDLING

PART 2 PRODUCTS

- 2.1 FORM MATERIALS
 - 2.1.1 Forms For Class A and Class B Finish
 - 2.1.2 Forms For Class C Finish
 - 2.1.3 Forms For Class D Finish
 - 2.1.4 Retain-In-Place Metal Forms
 - 2.1.5 Pan-Form Units
 - 2.1.6 Form Ties
- 2.2 FIBER VOID RETAINERS
 - 2.2.1 Precast Concrete

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Formwork
- 3.2 CHAMFERING
- 3.3 COATING
- 3.4 REMOVAL OF FORMS

-- End of Section Table of Contents --

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Design; FIO.

Design analysis and calculations for form design and methodology used in the design.

Concrete Formwork; FIO.

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.4 STORAGE AND HANDLING

Fiber voids shall be stored above ground level in a dry location. Fiber

voids shall be kept dry until installed and overlaid with concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in Section 05300 STEEL DECKING.

2.1.5 Pan-Form Units

Pan-form units for one-way or two-way concrete joist and slab construction shall be factory-fabricated units of the approximate section indicated. Units shall consist of steel or molded fiberglass concrete form pans. Closure units shall be furnished as required.

2.1.6 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.2 FIBER VOID RETAINERS

2.2.1 Precast Concrete

Precast concrete units shall have a compressive strength of not less than 4000 psi.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.4 REMOVAL OF FORMS

Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. In no case will supporting forms or shores be removed before the concrete strength has reached 70 percent of design strengths as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

| | |
|---|---|
| 1. Variations from the plumb: | In any 10 feet of length ---- 1/4 inch |
| a. In the lines and surfaces of columns, piers, walls and in arises | Maximum for entire length --- 1 inch |
| b. For exposed corner columns, control-joint grooves, and other conspicuous lines | In any 20 feet of length ---- 1/4 inch Maximum for entire length --- 1/2 inch |
| 2. Variation from the level or from the grades indicated on the drawings: | In any 10 feet of length ---- 1/4 inch In any bay or in any 20 feet of length ----- 3/8 inch |
| a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores | Maximum for entire length --- 3/4 inch |
| b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines | In any bay or in any 20 feet of length ----- 1/4 inch Maximum for entire length --- 1/2 inch |
| 3. Variation of the linear building lines from established position in plan | In any 20 feet ----- 1/2 inch Maximum ----- 1 inch |
| 4. Variation of distance between walls, columns, partitions | 1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation |
| 5. Variation in the sizes and locations of sleeves, floor openings, and wall opening | Minus ----- 1/4 inch Plus ----- 1/2 inch |
| 6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls | Minus ----- 1/4 inch Plus ----- 1/2 inch |
| 7. Footings: | |
| a. Variation of dimensions in plan when formed or plus 3 inches when placed against unformed excavation | Minus ----- 1/2 inch Plus ----- 2 inches |
| b. Misplacement of eccentricity | 2 percent of the footing width in the direction of misplacement but not more than ----- 2 inches |

TABLE 1

| <u>TOLERANCES FOR FORMED SURFACES</u> | | |
|---------------------------------------|-------------|-------------------------------------|
| c. Reduction in thickness | Minus ----- | 5 percent of specified thickness |
| 8. Variation in steps: | Riser ----- | 1/8 inch |
| a. In a flight of stairs | Tread ----- | 1/4 inch |
| b. In consecutive steps | Riser ----- | 1/16 inch |
| | Tread ----- | 1/8 inch |
| -- End of Section -- | | |

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 WELDING
- 1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 FABRICATED BAR MATS
- 2.2 REINFORCING STEEL
- 2.3 WELDED WIRE FABRIC
- 2.4 WIRE TIES
- 2.5 SUPPORTS
- 2.6 SYNTHETIC FIBER REINFORCEMENT

PART 3 EXECUTION

- 3.1 REINFORCEMENT
 - 3.1.1 Placement
 - 3.1.2 Splicing
- 3.2 WELDED-WIRE FABRIC PLACEMENT
- 3.3 DOWEL INSTALLATION
- 3.4 SYNTHETIC FIBER REINFORCED CONCRETE

-- End of Section Table of Contents --

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

| | |
|--------------|--|
| ACI 318/318R | (1995) Building Code Requirements for Structural Concrete and Commentary |
|--------------|--|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------------|--|
| ASTM A 82 | (1995a) Steel Wire, Plain, for Concrete Reinforcement |
| ASTM A 184/A 184M | (1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement |
| ASTM A 185 | (1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement |
| ASTM A 496 | (1995a) Steel Wire, Deformed, for Concrete Reinforcement |
| ASTM A 497 | (1995) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement |
| ASTM A 615/A 615M | (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| ASTM A 775/A 775M | (1996) Epoxy-Coated Reinforcement Steel Bars |
| ASTM A 884/A 884M | (1996a) Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement |
| ASTM C 1116 | (1995) Fiber-Reinforced Concrete and Shotcrete |

AMERICAN WELDING SOCIETY (AWS)

| | |
|----------|--|
| AWS D1.4 | (1992) Structural Welding Code - Reinforcing Steel |
|----------|--|

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1

(1996) Manual of Standard Practice

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Concrete Reinforcement System; FIO.

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-08 Statements

Welding; FIO.

A list of qualified welders names.

SD-13 Certificates

Reinforcing Steel; FIO.

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

2.2 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82. In highly corrosive environments or when directed by the Contracting Officer, reinforcing steel shall conform to ASTM A 775/A 775M as appropriate.

2.3 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185, ASTM A 496, and ASTM A 497. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A 884/A 884M.

2.4 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.5 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

2.6 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 2 inches.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.4 SYNTHETIC FIBER REINFORCED CONCRETE

Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of ASTM C 1116 and the recommendations of the manufacturer, and in an amount of 0.1 percent by volume.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03250

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 CONTRACTION JOINT STRIPS
- 2.2 PREFORMED EXPANSION JOINT FILLER
- 2.3 SEALANT
 - 2.3.1 Preformed Polychloroprene Elastomeric Type
 - 2.3.2 Lubricant for Preformed Compression Seals
 - 2.3.3 Hot-Poured Type
 - 2.3.4 Field Molded Type
- 2.4 WATERSTOPS
 - 2.4.1 Flexible Metal
 - 2.4.2 Rigid Metal
 - 2.4.3 Non-Metallic
 - 2.4.4 Non-Metallic Hydrophilic
 - 2.4.5 Preformed Elastic Adhesive
 - 2.4.5.1 Chemical Composition
 - 2.4.5.2 Adhesion Under Hydrostatic Pressure
 - 2.4.5.3 Sag of Flow Resistance
 - 2.4.5.4 Chemical Resistance

PART 3 EXECUTION

- 3.1 JOINTS
 - 3.1.1 Contraction Joints
 - 3.1.1.1 Joint Strips
 - 3.1.1.2 Sawed Joints
 - 3.1.2 Expansion Joints
 - 3.1.3 Joint Sealant
 - 3.1.3.1 Joints With Preformed Compression Seals
 - 3.1.3.2 Joints With Field-Molded Sealant
- 3.2 WATERSTOPS, INSTALLATION AND SPLICES
 - 3.2.1 Copper And Stainless Steel
 - 3.2.2 Flat Steel
 - 3.2.3 Non-Metallic
 - 3.2.3.1 Rubber Waterstop
 - 3.2.3.2 Polyvinyl Chloride Waterstop
 - 3.2.3.3 Quality Assurance
 - 3.2.4 Non-Metallic Hydrophilic Waterstop Installation
 - 3.2.5 Preformed Plastic Adhesive Installation
- 3.3 CONSTRUCTION JOINTS

-- End of Section Table of Contents --

SECTION 03250

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109 (1993) Steel, Strip, Carbon, Cold-Rolled

ASTM A 167 (1994a) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 480 (1995a) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A 570 (1995) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM B 152 (1994) Copper Sheet, Strip, Plate, and Rolled Bar

ASTM B 370 (1992) Copper Sheet and Strip for Building Construction

ASTM C 919 (1984; R 1992) Standard Practice for Use of Sealants in Acoustical Applications

ASTM C 920 (1994) Elastomeric Joint Sealants

ASTM D 4 (1986; R 1993) Bitumen Content

ASTM D 6 (1980; R 1990) Loss on Heating of Oil and Asphaltic Compounds

ASTM D 412 (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

ASTM D 471 (1995) Rubber Property - Effect of Liquids

ASTM D 1190 (1994) Concrete Joint Sealer, Hot-Poured Elastic Type

| | |
|-------------|---|
| ASTM D 1191 | (1984; R 1994) Test Methods for Concrete Joint Sealers |
| ASTM D 1751 | (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D 1752 | (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |
| ASTM D 2628 | (1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements |
| ASTM D 2835 | (1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements |
| ASTM D 5249 | (1992) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints |

CORPS OF ENGINEERS (COE)

| | |
|---------------|---|
| COE CRD-C 513 | (1974) Corps of Engineers Specifications for Rubber Waterstops |
| COE CRD-C 572 | (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

SD-04 Drawings

Waterstops; FIO.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

SD-06 Instructions

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

SD-13 Certificates

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

SD-14 Samples

Preformed Compression Seals and Lubricants; FIO.

Field-Molded Sealant and Primer; FIO.

Non-metallic Waterstops and Splices; FIO.

1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.3 SEALANT

Joint sealant shall conform to the following:

2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D 2628.

2.3.2 Lubricant for Preformed Compression Seals

ASTM D 2835.

2.3.3 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

2.3.4 Field Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

2.4.1 Flexible Metal

Copper waterstops shall conform to ASTM B 152 and ASTM B 370, O60 soft anneal temper and 20 oz mass per sq ft sheet thickness. Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480, UNS S30453 (Type 304L), and 20 gauge thick strip.

2.4.2 Rigid Metal

Flat steel waterstops shall conform to ASTM A 109, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 570, Grade 40.

2.4.3 Non-Metallic

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.4.4 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

2.4.5 Preformed Elastic Adhesive

Preformed plastic adhesive waterstops shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

2.4.5.1 Chemical Composition

The chemical composition of the sealing compound shall meet the requirements shown below.

| COMPONENT | TEST | PERCENT BY WEIGHT | |
|-----------|------|-------------------|------|
| | | MIN. | MAX. |

| | | | |
|-------------------------------|--------------|----|----|
| Bitumen (Hydrocarbon plastic) | ASTM D 4 | 50 | 70 |
| Inert Mineral Filler | AASHTO T 111 | 30 | 50 |
| Volatile Matter | ASTM D 6 | -- | 2 |

2.4.5.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

2.4.5.3 Sag of Flow Resistance

No sagging shall be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

2.4.5.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. Means shall be provided to insure true alignment of the strips is maintained during insertion.

3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the

required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top thereof to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.1.3.1 Joints With Preformed Compression Seals

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

3.1.3.2 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed.

Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when

concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

3.2.1 Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall be annealed to maintain physical properties. No carbon flame shall be used in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 1 inch onto undamaged portion of the waterstop.

3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.2.3.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

3.2.5 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03300

CAST-IN-PLACE STRUCTURAL AND MINOR CONCRETE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 LUMP SUM CONTRACT
- 1.3 SUBMITTALS
- 1.4 QUALIFICATIONS
- 1.5 GENERAL REQUIREMENTS
 - 1.5.1 Tolerances
 - 1.5.1.1 Floors
 - 1.5.1.2 Floors by the Straightedge System
 - 1.5.2 Strength Requirements and w/c Ratio
 - 1.5.2.1 Strength Requirements
 - 1.5.2.2 Water-Cement Ratio
 - 1.5.3 Air Entrainment
 - 1.5.4 Slump
 - 1.5.5 Concrete Temperature
 - 1.5.6 Size of Coarse Aggregate
 - 1.5.7 Special Properties and Products
- 1.6 MIXTURE PROPORTIONS
 - 1.6.1 Proportioning Studies for Normal Weight Concrete
 - 1.6.2 Proportioning Studies for Flexural Strength Concrete
 - 1.6.2.1 Computations from Test Records
 - 1.6.2.2 Computations without Previous Test Records
 - 1.6.3 Average Flexural Strength Required for Mixtures
 - 1.6.4 Mix Design for Bonded Topping for Heavy Duty Floors
- 1.7 STORAGE OF MATERIALS
- 1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING
 - 1.8.1 Materials
 - 1.8.2 Fresh Concrete
 - 1.8.3 Hardened Concrete
 - 1.8.4 Inspection

PART 2 PRODUCTS

- 2.1 CEMENTITIOUS MATERIALS
 - 2.1.1 Portland Cement
 - 2.1.2 High-Early-Strength Portland Cement
 - 2.1.3 Blended Cements
 - 2.1.4 Pozzolan (Fly Ash)
- 2.2 AGGREGATES
 - 2.2.1 Fine Aggregate
 - 2.2.2 Coarse Aggregate
 - 2.2.3 Materials for Bonded Topping for Heavy Duty Floors
- 2.3 CHEMICAL ADMIXTURES
 - 2.3.1 Air-Entraining Admixture
 - 2.3.2 Accelerating Admixture

- 2.3.3 Water-Reducing or Retarding Admixture
- 2.3.4 High-Range Water Reducer
- 2.3.5 Surface Retarder
- 2.3.6 Expanding Admixture
- 2.3.7 Other Chemical Admixtures
- 2.4 CURING MATERIALS
 - 2.4.1 Impervious-Sheet
 - 2.4.2 Membrane-Forming Compound
 - 2.4.3 Burlap and Cotton Mat
- 2.5 WATER
- 2.6 NONSHRINK GROUT
- 2.7 NONSLIP SURFACING MATERIAL
- 2.8 LATEX BONDING AGENT
- 2.9 EPOXY RESIN
- 2.10 EMBEDDED ITEMS
- 2.11 FLOOR HARDENER
- 2.12 PERIMETER INSULATION
- 2.13 VAPOR BARRIER
- 2.14 JOINT MATERIALS
 - 2.14.1 Joint Fillers, Sealers, and Waterstops
 - 2.14.2 Contraction Joints in Slabs

PART 3 EXECUTION

- 3.1 PREPARATION FOR PLACING
 - 3.1.1 Foundations
 - 3.1.1.1 Concrete on Earth Foundations
 - 3.1.1.2 Preparation of Rock
 - 3.1.1.3 Excavated Surfaces in Lieu of Forms
 - 3.1.1.4 Preparation of Previously Placed Concrete
 - 3.1.2 Vapor Barrier
 - 3.1.3 Perimeter Insulation
 - 3.1.4 Embedded Items
- 3.2 CONCRETE PRODUCTION
 - 3.2.1 Batching, Mixing, and Transporting Concrete
 - 3.2.1.1 General
 - 3.2.1.2 Batching Equipment
 - 3.2.1.3 Scales
 - 3.2.1.4 Batching Tolerances
 - 3.2.1.5 Moisture Control
 - 3.2.1.6 Concrete Mixers
 - 3.2.1.7 Stationary Mixers
- 3.3 FIBER REINFORCED CONCRETE
- 3.4 TRANSPORTING CONCRETE TO PROJECT SITE
- 3.5 CONVEYING CONCRETE ON SITE
 - 3.5.1 Buckets
 - 3.5.2 Transfer Hoppers
 - 3.5.3 Trucks
 - 3.5.4 Chutes
 - 3.5.5 Belt Conveyors
 - 3.5.6 Concrete Pumps
- 3.6 PLACING CONCRETE
 - 3.6.1 Depositing Concrete
 - 3.6.2 Consolidation
 - 3.6.3 Cold Weather Requirements
 - 3.6.4 Hot Weather Requirements
 - 3.6.5 Prevention of Plastic Shrinkage Cracking
 - 3.6.6 Placing Concrete Underwater
 - 3.6.7 Placing Concrete in Congested Areas

- 3.6.8 Placing Flowable Concrete
- 3.7 JOINTS
 - 3.7.1 Construction Joints
 - 3.7.2 Contraction Joints in Slabs on Grade
 - 3.7.3 Expansion Joints
 - 3.7.4 Waterstops
 - 3.7.5 Dowels and Tie Bars
- 3.8 FINISHING FORMED SURFACES
 - 3.8.1 Class B Finish
 - 3.8.1.1 Smooth Finish
 - 3.8.1.2 Tooled Finish
- 3.9 REPAIRS
 - 3.9.1 Damp-Pack Mortar Repair
 - 3.9.2 Repair of Major Defects
 - 3.9.2.1 Surface Application of Mortar Repair
 - 3.9.2.2 Repair of Deep and Large Defects
- 3.10 FINISHING UNFORMED SURFACES
 - 3.10.1 General
 - 3.10.2 Rough Slab Finish
 - 3.10.3 Floated Finish
 - 3.10.4 Troweled Finish
 - 3.10.5 Non-Slip Finish
 - 3.10.5.1 Broomed
 - 3.10.5.2 Abrasive Aggregate
- 3.11 EXTERIOR SLAB AND RELATED ITEMS
 - 3.11.1 Pavements
 - 3.11.2 Sidewalks
 - 3.11.3 Curbs and Gutters
 - 3.11.4 Pits and Trenches
- 3.12 CURING AND PROTECTION
 - 3.12.1 General
 - 3.12.2 Moist Curing
 - 3.12.3 Ponding or Immersion
 - 3.12.4 Cold Weather Curing and Protection
- 3.13 SETTING BASE PLATES AND BEARING PLATES
 - 3.13.1 Damp-Pack Bedding Mortar
 - 3.13.2 Nonshrink Grout
 - 3.13.2.1 Mixing and Placing of Nonshrink Grout
 - 3.13.2.2 Treatment of Exposed Surfaces
- 3.14 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL
 - 3.14.1 Grading and Corrective Action
 - 3.14.1.1 Fine Aggregate
 - 3.14.1.2 Coarse Aggregate
 - 3.14.2 Quality of Aggregates
 - 3.14.3 Scales, Batching and Recording
 - 3.14.4 Batch-Plant Control
 - 3.14.5 Concrete Mixture
 - 3.14.6 Inspection Before Placing
 - 3.14.7 Placing
 - 3.14.8 Vibrators
 - 3.14.9 Curing Inspection
 - 3.14.10 Cold-Weather Protection
 - 3.14.11 Mixer Uniformity
 - 3.14.12 Reports

-- End of Section Table of Contents --

SECTION 03300

CAST-IN-PLACE STRUCTURAL AND MINOR CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

| | |
|--------------|---|
| ACI 117/117R | (1990; Errata) Standard Tolerances for Concrete Construction and Materials |
| ACI 211.1 | (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| ACI 214.3R | (1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results |
| ACI 305R | (1991) Hot Weather Concreting |
| ACI 318/318R | (1995) Building Code Requirements for Reinforced Concrete and Commentary |

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

| | |
|--------------|---|
| AASHTO M 182 | (1991) Burlap Cloth Made From Jute or Kenaf |
|--------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-----------|---|
| ASTM C 31 | (1991) Making and Curing Concrete Test Specimens in the Field |
| ASTM C 33 | (1993) Concrete Aggregates |
| ASTM C 39 | (1994) Compressive Strength of Cylindrical Concrete Specimens |
| ASTM C 42 | (1994) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |
| ASTM C 78 | (1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading) |
| ASTM C 94 | (1996) Ready-Mixed Concrete |

| | |
|-------------|--|
| ASTM C 131 | (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C 136 | (1995a) Sieve Analysis of Fine and Coarse Aggregates |
| ASTM C 143 | (1990a) Slump of Hydraulic Cement Concrete |
| ASTM C 150 | (1995) Portland Cement |
| ASTM C 171 | (1995) Sheet Materials for Curing Concrete |
| ASTM C 172 | (1990) Sampling Freshly Mixed Concrete |
| ASTM C 173 | (1994a) Air Content of Freshly Mixed Concrete by the Volumetric Method |
| ASTM C 192 | (1990a) Making and Curing Concrete Test Specimens in the Laboratory |
| ASTM C 231 | (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C 260 | (1995) Air-Entraining Admixtures for Concrete |
| ASTM C 309 | (1995) Liquid Membrane-Forming Compounds for Curing Concrete |
| ASTM C 494 | (1992) Chemical Admixtures for Concrete |
| ASTM C 552 | (1991) Cellular Glass Thermal Insulation |
| ASTM C 578 | (1995) Rigid, Cellular Polystyrene Thermal Insulation |
| ASTM C 591 | (1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation |
| ASTM C 595 | (1995a) Blended Hydraulic Cements |
| ASTM C 618 | (1996a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete |
| ASTM C 881 | (1990) Epoxy-Resin-Base Bonding Systems for Concrete |
| ASTM C 937 | (1980; R 1991) Grout Fluidifier for Preplaced-Aggregate Concrete |
| ASTM C 940 | (1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory |
| ASTM C 1017 | (1992) Chemical Admixtures for Use in Producing Flowing Concrete |

| | |
|-------------|---|
| ASTM C 1059 | (1991) Latex Agents for Bonding Fresh to Hardened Concrete |
| ASTM C 1064 | (1986; R 1993) Temperature of Freshly Mixed Portland Cement Concrete |
| ASTM C 1077 | (1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |
| ASTM C 1107 | (1991a) Packaged Dry, Hydraulic-Cement Grout (Nonshrink) |
| ASTM C 1116 | (1991) Fiber-Reinforced Concrete and Shotcrete |
| ASTM D 75 | (1987; R 1992) Sampling Aggregates |
| ASTM D 1751 | (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |

CORPS OF ENGINEERS (COE)

| | |
|---------------|---|
| COE CRD-C 94 | (1995) Surface Retarders |
| COE CRD-C 104 | (1980) Method of Calculation of the Fineness Modulus of Aggregate |
| COE CRD-C 400 | (1963) Requirements for Water for Use in Mixing or Curing Concrete |
| COE CRD-C 521 | (1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete |
| COE CRD-C 540 | (1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type |
| COE CRD-C 572 | (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop |

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

| | |
|------------|--|
| NIST HB 44 | (1995) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices |
|------------|--|

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

| | |
|---------------|---|
| NRMCA TMMB-01 | (1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of |
|---------------|---|

the Truck Mixer Manufacturers Bureau

NRMCA CPMB 100

(1990) Concrete Plant Standards

NRMCA QC 3

(1984) Quality Control Manual: Section 3,
Plant Certifications Checklist:
Certification of Ready Mixed Concrete
Production Facilities

1.2 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Mixture Proportions; GA.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports

Testing and Inspection for Contractor Quality Control; GA.

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

SD-13 Certificates

Qualifications; FIO.

Written documentation for Contractor Quality Control personnel.

SD-14 Samples

Surface Retarder; FIO.

Surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

1.4 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

1.5 GENERAL REQUIREMENTS

1.5.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.5.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

| Floor Profile Quality | |
|----------------------------------|-------------------------------|
| Classification From ACI 117/117R | This Section |
| ----- | ----- |
| Conventional Bullfloated | Same |
| Conventional Straightedged | Same |
| Flat | Float Finish or Trowel Finish |
| Very Flat | Same. Use only with F-system |

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.5.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated 0.25"
Straightedged 0.25"

Float Finish 0.25"
Trowel Finish 0.25"

1.5.2 Strength Requirements and w/c Ratio

1.5.2.1 Strength Requirements

Specified compressive strength (f'_c) shall be as follows:

COMPRESSIVE STRENGTH

4000 psi at 28 days
3000 psi at 28 days

Concrete slabs on-grade shall have a 28-day flexural strength of 650 psi. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39. Flexural strength shall be determined in accordance with ASTM C 78.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (6 by 12 inch cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'_c and no individual test result falls below the specified strength f'_c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.
- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of

the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

- d. Evaluation of Concrete Flexural Strength. Flexural strength specimens (beams) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 78. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified flexural strength and no individual test result falls below the specified flexural strength by more than 50 psi. A "test" is defined as the average of two companion beams. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the slab is considered potentially deficient.

1.5.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT

0.45

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1.

In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.5.3 Air Entrainment

All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 5000 psi may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

1.5.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

| <u>Structural Element</u> | <u>Minimum</u> | <u>Slump Maximum</u> |
|--|----------------|--------------------------|
| Walls, columns and beams | 2 in. | 4 in. |
| Foundation walls, substructure walls, footings, slabs | 1 in. | 3 in. |
| Any structural concrete approved for placement by pumping: | | |
| At pump | 2 in. | 6 in. |
| At discharge of line | 1 in. | 4 in. |

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added. For troweled floors, slump of structural lightweight concrete with normal weight sand placed by pump shall not exceed 5 inches at the point of placement. For other slabs, slump of lightweight concrete shall not exceed 4 inches at point of placement.

1.5.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.5.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.5.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.6 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.6.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural

strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in the paragraph Maximum Allowable w/c Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39.

From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.6.2 Proportioning Studies for Flexural Strength Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete, except that proportions shall be based on flexural strength as determined by test specimens (beams) fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 78. Procedures given in ACI 211.1 shall be modified as necessary to accommodate flexural strength.

1.6.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'_c) within 1,000 psi of that specified for

proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'_{cr} used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$f'_{cr} = f'_c +$ where units are in psi

$f'_{cr} = f'_c + 2.33S - 500$ where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

| NUMBER OF TESTS | MODIFICATION FACTOR FOR STANDARD DEVIATION |
|-----------------|---|
| 15 | 1.16 |
| 20 | 1.08 |
| 25 | 1.03 |
| 30 or more | 1.00 |

1.6.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'_{cr} shall be determined as follows:

- If the specified compressive strength f'_c is less than 3,000 psi,
 $f'_{cr} = f'_c + 1000$ psi
- If the specified compressive strength f'_c is 3,000 to 5,000 psi,
 $f'_{cr} = f'_c + 1,200$ psi
- If the specified compressive strength f'_c is over 5,000 psi,
 $f'_{cr} = f'_c + 1,400$ psi

1.6.3 Average Flexural Strength Required for Mixtures

The mixture proportions selected during mixture design studies for flexural strength mixtures and the mixture used during concrete production shall be designed and adjusted during concrete production as approved, except that the overdesign for average flexural strength shall simply be 15 percent greater than the specified flexural strength at all times.

1.6.4 Mix Design for Bonded Topping for Heavy Duty Floors

The concrete mix design for bonded topping for heavy duty floors shall contain the greatest practical proportion of coarse aggregate within the specified proportion limits. The mix shall be designed to produce concrete having a 28-day strength of at least 5000 psi. Concrete for the topping

shall consist of the following proportions, by weight:

- 1.00 part portland cement
- 1.15 to 1.25 parts fine aggregate
- 1.80 to 2.00 parts coarse aggregate

Maximum w/c shall be 0.33. The topping concrete shall not be air-entrained. The concrete shall be mixed so as to produce a mixture of the driest consistency possible to work with a sawing motion of the strike-off and which can be floated and compacted as specified without producing water or excess cement at the surface. In no case shall slump exceed 1 inch as determined by ASTM C 143.

1.7 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.8.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.8.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.8.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such

tests are considered necessary.

1.8.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, portland-pozzolan cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type II low alkali including false set requirements or Type V. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali. White Type III shall be used only in specific areas of the structure, when approved in writing.

2.1.2 High-Early-Strength Portland Cement

ASTM C 150, Type III with tricalcium aluminate limited to 5 percent, low alkali. Type III cement shall be used only in isolated instances and only when approved in writing.

2.1.3 Blended Cements

ASTM C 595, Type IP.

2.1.4 Pozzolan (Fly Ash)

ASTM C 618, Class C with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalis from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S.

2.2.3 Materials for Bonded Topping for Heavy Duty Floors

In addition to the requirements specified above, coarse aggregate used for this purpose shall be a well graded, hard, sound diabase, trap rock, emery, granite or other natural or manufactured aggregate having equivalent hardness and wearing qualities and shall have a percentage of loss not to exceed 30 after 500 revolutions when tested in accordance with ASTM C 131. Gradation of the aggregates when tested in accordance with ASTM C 136 shall be as follows:

Coarse Aggregate

| Sieve Size | Cumulative Percent By Weight Passing |
|------------|---|
| 3/4 in. | 100 |
| 1/2 in. | 50-100 |
| 3/8 in. | 25-50 |
| No. 4 | 0-15 |
| No. 8 | 0-8 |

Fine Aggregate

| Sieve Size | Cumulative Percent By Weight Passing |
|------------|---|
| 3/8 in. | 100 |
| No. 4 | 95-100 |
| No. 8 | 65-80 |
| No. 16 | 45-65 |
| No. 30 | 25-45 |
| No. 50 | 5-15 |
| No. 100 | 0-5 |

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grade A, and shall be a commercial formulation suitable for the proposed application.

2.7 NONSLIP SURFACING MATERIAL

Nonslip surfacing material shall consist of 55 percent, minimum, aluminum oxide or silicon-dioxide abrasive ceramically bonded together to form a homogeneous material sufficiently porous to provide a good bond with portland cement paste; or factory-graded emery aggregate consisting of not less than 45 percent aluminum oxide and 25 percent ferric oxide. The aggregate shall be well graded from particles retained on the No. 30 sieve to particles passing the No. 8 sieve.

2.8 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.9 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.10 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.11 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.12 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV.

2.13 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

2.14 JOINT MATERIALS

2.14.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751. Materials for waterstops shall be in accordance with Section 03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section 07900 JOINT SEALING.

2.14.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the

exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings and walls may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.1.4 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.2 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 12 inches. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier.

In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 2 inch layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

3.1.3 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.1.4 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 foot of the surface of the concrete.

Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-01. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

3.2.1.1 General

The batching plant shall be located on site in the general area indicated on the drawings. The batching, mixing and placing system shall have a capacity of at least 50 cubic yards per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

3.2.1.4 Batching Tolerances

(A) Tolerances with Weighing Equipment

| MATERIAL | PERCENT OF REQUIRED WEIGHT |
|------------------------|-------------------------------|
| Cementitious materials | 0 to plus 2 |
| Aggregate | plus or minus 2 |
| Water | plus or minus 1 |
| Chemical admixture | 0 to plus 6 |

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

| MATERIAL | PERCENT OF REQUIRED MATERIAL |
|----------------------|---------------------------------|
| Water: | plus or minus 1 percent |
| Chemical admixtures: | 0 to plus 6 percent |

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

3.3 FIBER REINFORCED CONCRETE

Fiber reinforced concrete shall conform to ASTM C 1116 and as follows, using the fibers specified in PART 2. A minimum of 1.5 pounds of fibers per cubic yard of concrete shall be used. Fibers shall be added at the batch plant. Toughness indices shall meet requirements for performance level I of ASTM C 1116. The services of a qualified technical

representative shall be provided to instruct the concrete supplier in proper batching and mixing of materials to be provided.

3.4 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in agitators or by approved pumping equipment. Nonagitating equipment, other than pumps, shall not be used for transporting concrete.

3.5 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.5.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.5.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.5.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.5.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.5.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper, for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.5.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.6 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.6.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete

for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.6.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.6.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.6.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper

concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

| Relative Humidity, Percent, During Time of Concrete Placement | Maximum Allowable Concrete Temperature Degrees |
|---|--|
| Greater than 60 | 90 F |
| 40-60 | 85 F |
| Less than 40 | 80 F |

3.6.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.6.6 Placing Concrete Underwater

Concrete shall be deposited in water by a tremie or concrete pump. The methods and equipment used shall be subject to approval. Concrete buckets shall not be used for underwater placement of concrete except to deliver concrete to the tremie. The tremie shall be watertight and sufficiently large to permit a free flow of concrete. The concrete shall be deposited so that it enters the mass of the previously placed concrete from within, displacing water with a minimum disturbance to the surface of the concrete.

The discharge end of the pump line or tremie shaft shall be kept continuously submerged in the concrete. The underwater seal at start of placing shall not produce undue turbulence in the water. The tremie shaft shall be kept full of concrete to a point well above the water surface. Placement shall proceed without interruption until the concrete has been brought to the required height. The tremie shall not be moved horizontally during a placing operation, and a sufficient number of tremies shall be provided so that the maximum horizontal flow of concrete will be limited to 15 feet. Concrete shall not be deposited in running water or in water with a temperature below 35 degrees F.

3.6.7 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete

and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.6.8 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.7 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07900 JOINT SEALING.

3.7.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 30 feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the

concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.7.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations, use of snap-out plastic joint forming inserts or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.7.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07900 JOINT SEALING.

3.7.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03250 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.7.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.8 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish

is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.8.1 Class B Finish

Class B finish is required where indicated on the drawings. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained.

3.8.1.1 Smooth Finish

After other concrete construction is complete in each overall separate contiguous area of the structure, smooth finish shall be applied to the areas indicated on the drawings. A mortar mix consisting of one part portland cement and two parts well-graded sand passing a No. 30 sieve, with water added to give the consistency of thick paint, shall be used. Where the finished surface will not receive other applied surface, white cement shall be used to replace part of the job cement to produce an approved color, which shall be uniform throughout the surfaces of the structure. After the surface has been thoroughly wetted and allowed to approach surface dryness, the mortar shall be vigorously applied to the area by clean burlap pads or by cork or wood-floating, to completely fill all surface voids. Excess grout shall be scraped off with a trowel. As soon as it can be accomplished without pulling the mortar from the voids, the area shall be rubbed with burlap pads having on their surface the same sand-cement mix specified above but without any mixing water, until all of the visible grout film is removed. The burlap pads used for this operation shall be stretched tightly around a board to prevent dishing the mortar in the voids. The finish of any area shall be completed in the same day, and

the limits of a finished area shall be made at natural breaks in the surface. The surface shall be continuously moist cured for 48 hours commencing immediately after finishing operations in each area. The temperature of the air adjacent to the surface shall be not less than 50 degrees F for 24 hours prior to, and 48 hours after, the application. In hot, dry weather the smooth finish shall be applied in shaded areas or at night, and shall never be applied when there is significant hot, dry wind.

3.8.1.2 Tooled Finish

The thoroughly cured concrete shall be dressed at an approved age with approved electric, air, or hand tools to a uniform texture with a hand-tooled surface texture. The finish shall be similar to and shall closely match the finish on the approved preconstruction test panel fabricated by the Contractor.

3.9 REPAIRS

3.9.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.9.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.9.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by

high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.9.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.10 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of

paragraph Tolerances in PART 1, when tested as specified herein.

3.10.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.10.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough slab finish prepared as follows. Areas indicated on the drawings shall receive only a rough slab finish. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.10.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. Areas as indicated on the drawings shall be given only a float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum.

3.10.4 Troweled Finish

Areas as indicated on the drawings shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 3 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.10.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.10.5.1 Broomed

Areas as indicated on the drawings shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.10.5.2 Abrasive Aggregate

Areas as indicated on the drawings shall be given an abrasive aggregate finish. The concrete surface shall be given a float finish. Abrasive aggregate shall then immediately be uniformly sprinkled over the floated surface at a total rate of not less than 0.25 psf spread in two applications at right angles to each other. The surface shall then be troweled to a smooth, even finish that is uniform in texture and appearance and free from blemishes including trowels marks. Immediately after curing, cement paste and laitance covering the abrasive aggregate shall be removed by steel brushing, rubbing with abrasive stone, or sandblasting to expose the abrasive particles.

3.11 EXTERIOR SLAB AND RELATED ITEMS

3.11.1 Pavements

Pavements shall be constructed where shown on the drawings. After forms are set and underlying material prepared as specified, the concrete shall be placed uniformly throughout the area and thoroughly vibrated. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the

required elevation. The entire surface shall be tamped with the strike off, or consolidated with a vibrating screed, and this operation continued until the required compaction and reduction of internal and surface voids are accomplished. Care shall be taken to prevent bringing excess paste to the surface. Immediately following the final consolidation of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. After finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled cutting straightedges. Straightedges shall be 12 feet in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 3 feet longer than one-half the width of the pavement. The surface shall then be tested for trueness with a 12 foot straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is true. Before the surface sheen has disappeared and well before the concrete becomes nonplastic, the surface of the pavement shall be given a nonslip sandy surface texture by use of a burlap drag. A strip of clean, wet burlap from 3 to 5 feet wide and 2 feet longer than the pavement width shall be carefully pulled across the surface. Edges and joints shall be rounded with an edger having a radius of 1/8 inch. Curing shall be as specified.

3.11.2 Sidewalks

Concrete shall be 4 inches minimum thickness. Contraction joints shall be provided at 5 feet spaces unless otherwise indicated. Contraction joints shall be cut 1 inch deep with a jointing tool after the surface has been finished. Transverse expansion joints 1/2 inch thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed finish. A transverse slope of 1/4 inch per foot shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1/4 inch in 5 feet.

3.11.3 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 3 inches deep with a jointing tool after the surface has been finished. Expansion joints (1/2 inch wide) shall be provided at 100 feet maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

3.11.4 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys,

shall be provided as approved.

3.12 CURING AND PROTECTION

3.12.1 General

Concrete shall be cured by an approved method for the period of time given below:

| | |
|-------------------------------|--------|
| Concrete with Type III cement | 3 days |
| All other concrete | 7 days |

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded

3.12.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.12.3 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.12.4 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal,

the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Government, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.13 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

3.13.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed.

The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.13.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.13.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

3.13.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with

sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.14 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per week thereafter for conformance with ASTM C 1077.

3.14.1 Grading and Corrective Action

3.14.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately be reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.14.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.14.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.14.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.14.5 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be

plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.
- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 1/2 inch below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples

for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the compressive strength data.
- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 500 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.14.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete

placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.14.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.14.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.14.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.14.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.14.11 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.14.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 04 - MASONRY

SECTION 04200

MASONRY

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, HANDLING, AND STORAGE
 - 1.3.1 Masonry Units
 - 1.3.2 Reinforcement, Anchors, and Ties
 - 1.3.3 Cementitious Materials, Sand and Aggregates
- 1.4 SPECIAL INSPECTION

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
- 2.2 CONCRETE BRICK
- 2.3 CONCRETE MASONRY UNITS (CMU)
 - 2.3.1 Aggregates
 - 2.3.2 Kinds and Shapes
 - 2.3.2.1 Architectural Units
 - 2.3.3 Fire-Rated CMU
- 2.4 PRECAST CONCRETE ITEMS
 - 2.4.1 Lintels
 - 2.4.2 Sills and Copings
 - 2.4.3 Splash Blocks
- 2.5 MORTAR
 - 2.5.1 Admixtures
- 2.6 GROUT
 - 2.6.1 Admixtures
 - 2.6.2 Grout Barriers
- 2.7 ANCHORS, TIES, AND BAR POSITIONERS
 - 2.7.1 Wire Mesh Ties
 - 2.7.2 Wall Ties
 - 2.7.3 Dovetail Anchors
 - 2.7.4 Adjustable Anchors
 - 2.7.5 Bar Positioners
- 2.8 JOINT REINFORCEMENT
- 2.9 REINFORCING STEEL BARS AND RODS
- 2.10 EXPANSION-JOINT MATERIALS
- 2.11 INSULATION
 - 2.11.1 Rigid Board-Type Insulation
 - 2.11.1.1 Aged R-Value
 - 2.11.1.2 Recovered Material
 - 2.11.2 Insulation Adhesive
- 2.12 FLASHING
- 2.13 WEEP HOLE VENTILATORS

PART 3 EXECUTION

- 3.1 ENVIRONMENTAL REQUIREMENTS
 - 3.1.1 Hot Weather Installation
 - 3.1.2 Cold Weather Installation
 - 3.1.2.1 Preparation
 - 3.1.2.2 Completed Masonry and Masonry Not Being Worked On
- 3.2 LAYING MASONRY UNITS
 - 3.2.1 Surface Preparation
 - 3.2.2 Forms and Shores
 - 3.2.3 Concrete Masonry Units
 - 3.2.4 Tolerances
 - 3.2.5 Cutting and Fitting
 - 3.2.6 Jointing
 - 3.2.6.1 Flush Joints
 - 3.2.6.2 Tooled Joints
 - 3.2.6.3 Door and Window Frame Joints
 - 3.2.7 Joint Widths
 - 3.2.7.1 Concrete Masonry Units
 - 3.2.8 Embedded Items
 - 3.2.9 Unfinished Work
 - 3.2.10 Masonry Wall Intersections
 - 3.2.11 Partitions
- 3.3 MORTAR
- 3.4 REINFORCING STEEL
 - 3.4.1 Positioning Bars
 - 3.4.2 Splices
- 3.5 JOINT REINFORCEMENT
- 3.6 PLACING GROUT
 - 3.6.1 Vertical Grout Barriers for Fully Grouted Walls
 - 3.6.2 Horizontal Grout Barriers
 - 3.6.3 Grout Holes and Cleanouts
 - 3.6.3.1 Grout Holes
 - 3.6.3.2 Cleanouts for Hollow Unit Masonry Construction
 - 3.6.4 Grouting Equipment
 - 3.6.4.1 Grout Pumps
 - 3.6.4.2 Vibrators
 - 3.6.5 Grout Placement
 - 3.6.5.1 Low-Lift Method
- 3.7 BOND BEAMS
- 3.8 CONTROL JOINTS
- 3.9 LINTELS
 - 3.9.1 Masonry Lintels
 - 3.9.2 Precast Concrete and Steel Lintels
- 3.10 SILLS AND COPINGS
- 3.11 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL
 - 3.11.1 Anchorage to Concrete
 - 3.11.2 Anchorage to Structural Steel
- 3.12 SPLASH BLOCKS
- 3.13 POINTING AND CLEANING
 - 3.13.1 Concrete Masonry Unit
- 3.14 BEARING PLATES
- 3.15 PROTECTION
- 3.16 TEST REPORTS
 - 3.16.1 Field Testing of Mortar
 - 3.16.2 Field Testing of Grout

-- End of Section Table of Contents --

SECTION 04200

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 (1994) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 153 (1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 615 (1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 55 (1995) Concrete Building Brick

ASTM C 90 (1995) Loadbearing Concrete Masonry Units

ASTM C 140 (1995a) Sampling and Testing Concrete Masonry Units

ASTM C 270 (1995) Mortar for Unit Masonry

ASTM C 476 (1991) Grout for Masonry

ASTM C 494 (1992) Chemical Admixtures for Concrete

ASTM C 578 (1992) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 641 (1982; R 1991) Staining Materials in Lightweight Concrete Aggregates

ASTM C 780 (1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

ASTM C 1019 (1989a; R 1993) Sampling and Testing Grout

ASTM C 1072 (1994) Measurement of Masonry Flexural Bond Strength

ASTM C 1289

(1995) Faced Rigid Cellular
Polyisocyanurate Thermal Insulation Board

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Concrete Brick; GA. Insulation; GA.

Manufacturer's descriptive data.

SD-04 Drawings

Masonry Work; GA.

Drawings showing the location and layout of block units. Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-08 Statements

Cold Weather Installation; GA.

Cold weather construction procedures.

SD-09 Reports

Efflorescence Test; GA. Field Testing of Mortar; GA. Field Testing of Grout; GA. Prism tests; GA. Fire-rated CMU; GA.

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; GA.

Copies of masonry inspector reports.

SD-13 Certificates

Concrete Brick; GA. Concrete Masonry Units (CMU); GA. Control Joint Keys;

GA. Anchors, Ties, and Bar Positioners; GA. Expansion-Joint Materials; GA. Joint Reinforcement; GA. Reinforcing Steel Bars and Rods; GA. Insulation; GA. Precast Concrete Items; GA. Mortar Admixtures; GA. Grout Admixtures; GA.

Certificates of compliance stating that the materials meet the specified requirements.

Insulation; GA.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

SD-14 Samples

Concrete Masonry Units (CMU); GA. Concrete Brick; GA

Anchors, Ties, and Bar Positioners; GA.

Two of each type used.

Expansion-Joint Material; GA.

One piece of each type used.

Joint Reinforcement; GA.

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

Insulation; GA.

One piece of board type insulation, not less than 16 inches by 24 inches in size, containing the label indicating the rated permeance and R-values.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.3.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.3.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened

containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.4 SPECIAL INSPECTION

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 CONCRETE BRICK

Concrete brick shall conform to ASTM C 55, Type I, Grade S. Concrete brick may be used where necessary for filling out in concrete masonry unit construction.

2.3 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I, Normal weight. Cement shall have a low alkali content and be of one brand.

2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform

fine to medium texture and a uniform color.

2.3.2.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be vertical scored or split ribbed. Patterned face shell shall be properly aligned in the completed wall.

2.3.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I
FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

| Aggregate Type | Minimum equivalent thickness in inches for fire rating of: | | |
|--|---|---------|---------|
| | 4 hours | 3 hours | 2 hours |
| Pumice | 4.7 | 4.0 | 3.0 |
| Expanded slag | 5.0 | 4.2 | 3.3 |
| Expanded clay, shale, or slate | 5.7 | 4.8 | 3.7 |
| Limestone, scoria, cinders or unexpanded slag | 5.9 | 5.0 | 4.0 |
| Calcareous gravel | 6.2 | 5.3 | 4.2 |
| Siliceous gravel | 6.7 | 5.7 | 4.5 |

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in inches. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.4 PRECAST CONCRETE ITEMS

Trim, lintels, copings, splashblocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 4,000 psi minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless

precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 pounds per square inch for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.4.1 Lintels

Precast lintels, unless otherwise shown, shall be of a thickness equal to the wall and reinforced with two No. 5 bars for the full length. Top of lintels shall be labeled "TOP" or otherwise identified and each lintel shall be clearly marked to show location in the structure.

2.4.2 Sills and Copings

Sills and copings shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 1/4 inch allowance for mortar joints. The ends of sills, except a 3/4 inch wide margin at exposed surfaces, shall be roughened for bond. Treads of door sills shall have rounded nosings.

2.4.3 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

2.5 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate. Masonry cement will not be permitted. Evaluation of performance shall be based on ASTM C 780 and ASTM C 1072. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the No. 8 sieve and 95 percent passing the No. 16 sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.5.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2.6 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.6.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2.6.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.7 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82.

Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

2.7.1 Wire Mesh Ties

Wire mesh for tying 4 inch thick concrete masonry unit partitions to other intersecting masonry partitions shall be 1/2 inch mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 12 inches.

2.7.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.7.3 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 3/16 inch diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7.4 Adjustable Anchors

Adjustable anchors shall be 3/16 inch diameter steel wire, triangular-shaped. Anchors attached to steel shall be 5/16 inch diameter steel bars placed to provide 1/16 inch play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.7.5 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.8 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615, Grade 60.

2.10 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900 JOINT SEALING.

2.11 INSULATION

2.11.1 Rigid Board-Type Insulation

Rigid board-type insulation shall be extruded polystyrene, polyurethane, or polyisocyanurate. Polystyrene shall conform to ASTM C 578. Polyurethane or polyisocyanurate shall conform to ASTM C 1289, Type I, Class 2, faced with aluminum foil on both sides of the foam. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

2.11.1.1 Aged R-Value

The insulation shall provide a minimum aged R-value of 11 for the overall thickness. The aged R-value shall be determined at 75 degrees F in accordance with the appropriate referenced specification. The stated

R-value of the insulation shall be certified by an independent testing laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

2.11.1.2 Recovered Material

Insulation shall contain the highest practicable percentage of recovered material derived from solid waste (but material reused in the manufacturing process cannot be counted toward the percentage of recovered material). Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. The polyurethane or polyisocyanurate foam shall have a minimum recovered material content of 9 percent by weight of the core material.

2.11.2 Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the masonry and, where applicable, to the thru-wall flashing. The adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.12 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.13 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall

be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F.
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 degrees F to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 32 degrees F to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 Degrees F to 20 Degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature 20 Degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

| | |
|---------------------------|----------|
| In adjacent masonry units | 1/8 inch |
| In 10 feet | 1/4 inch |
| In 20 feet | 3/8 inch |
| In 40 feet or more | 1/2 inch |

Variations from the plumb for external corners,
expansion joints, and other conspicuous lines

TOLERANCES

| | |
|--------------------|----------|
| In 20 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

| | |
|--------------------|----------|
| In 20 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variation from level for bed joints and top surfaces of bearing walls

| | |
|--------------------|----------|
| In 10 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from horizontal lines

| | |
|--------------------|----------|
| In 10 feet | 1/4 inch |
| In 20 feet | 3/8 inch |
| In 40 feet or more | 1/2 inch |

Variations in cross sectional dimensions of columns and in thickness of walls

| | |
|-------|----------|
| Minus | 1/4 inch |
| Plus | 1/2 inch |

3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting

off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of $\frac{3}{8}$ inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of $\frac{3}{8}$ inch.

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have $\frac{3}{8}$ inch joints, except for prefaced concrete masonry units.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.11 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings

on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 4 inches above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 4 inch nominal thick units shall be tied to intersecting partitions of 4 inch units, 5 inches into partitions of 6 inch units, and 7 inches into partitions of 8 inch or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 4 inches thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.4 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.4.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.4.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.5 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be

placed to provide not less than 5/8 inch cover to either face of the unit.

3.6 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.6.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.6.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.6.3 Grout Holes and Cleanouts

3.6.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.6.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.6.4 Grouting Equipment

3.6.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.6.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.6.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.6.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

| Maximum Grout Pour Height (feet) (4) | Grout Type | Grouting Procedure | Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) | |
|---|---------------|-----------------------|---|------------------------|
| | | | Multiwythe Masonry (3) | Hollow-unit Masonry |
| | | | | |

| | | | | |
|---|--------|----------|-------|-----------|
| 1 | Fine | Low Lift | 3/4 | 1-1/2 x 2 |
| 5 | Fine | Low Lift | 2 | 2 x 3 |
| 1 | Coarse | Low Lift | 1-1/2 | 1-1/2 x 3 |
| 5 | Coarse | Low Lift | 2 | 2-1/2 x 3 |

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
 - a) The required minimum dimensions of total clear areas given in the table above;
 - b) The width of any mortar projections within the space;
 - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.7 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.8 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07900 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.9 LINTELS

3.9.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the

bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.9.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.10 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.11 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.11.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.11.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.12 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.13 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.13.1 Concrete Masonry Unit

Exposed concrete masonry unit surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.14 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.15 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.16 TEST REPORTS

3.16.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.16.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 3000 psi at 28 days.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05055

WELDING, STRUCTURAL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
- 1.3 GENERAL REQUIREMENTS
- 1.4 SUBMITTALS
- 1.5 WELDING PROCEDURE QUALIFICATIONS
 - 1.5.1 Previous Qualifications
 - 1.5.2 Prequalified Procedures
 - 1.5.3 Retests
- 1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION
 - 1.6.1 Previous Qualifications
 - 1.6.2 Certificates
 - 1.6.3 Renewal of Qualification
- 1.7 INSPECTOR QUALIFICATION
- 1.8 SYMBOLS
- 1.9 SAFETY

PART 2 PRODUCTS

- 2.1 WELDING EQUIPMENT AND MATERIALS

PART 3 EXECUTION

- 3.1 WELDING OPERATIONS
 - 3.1.1 Requirements
 - 3.1.2 Identification
- 3.2 QUALITY CONTROL
- 3.3 STANDARDS OF ACCEPTANCE
 - 3.3.1 Nondestructive Examination
 - 3.3.2 DESTRUCTIVE TESTS
- 3.4 GOVERNMENT INSPECTION AND TESTING
- 3.5 CORRECTIONS AND REPAIRS

-- End of Section Table of Contents --

SECTION 05055

WELDING, STRUCTURAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC-04 (1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT-01 (1996) Recommended Practice SNT-TC-1A

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1993) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A3.0 (1994) Standard Welding Terms and Definitions

AWS D1.1 (1994) Structural Welding Code - Steel

AWS Z49.1 (1994) Safety in Welding and Cutting and Allied Processes

1.2 DEFINITIONS

Definitions of welding terms shall be in accordance with AWS A3.0.

1.3 GENERAL REQUIREMENTS

The design of welded connections shall conform to AISC-04 unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Welding shall be as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Welding shall not be started until welding procedures, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330SUBMITTAL PROCEDURES:

SD-08 Statements

Welding Procedure Qualifications; GA.

Welder, Welding Operator, and Tacker Qualification; GA.

Inspector Qualification; FIO.

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

SD-18 Records

Quality Control; FIO.

A quality assurance plan and records of tests and inspections.

1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1) and previously qualified procedures, each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1 and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1, this specification governs.

1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.5.2 Prequalified Procedures

Welding procedures which are considered prequalified as specified in AWS D1.1 will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification shall be required for these joints.

1.5.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1, the procedure specification shall be revised and requalified, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1. If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, shall be submitted with the welding procedure.

1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

Each welder, welding operator, and tacker assigned to work on this contract shall be qualified in accordance with the applicable requirements of AWS D1.1 and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

1.6.1 Previous Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

- a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, the Contractor shall submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. The certification shall be kept on

file, and 3 copies shall be furnished. The certification shall be kept current for the duration of the contract.

1.6.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

- a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.
- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified shall be submitted as evidence of conformance.
- d. A tacker who passes the qualification test shall be considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker shall be required to pass the prescribed tack welding test.

1.7 INSPECTOR QUALIFICATION

Inspection and nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT-01 for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT-01, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

1.9 SAFETY

Safety precautions during welding shall conform to AWS Z49.1.

PART 2 PRODUCTS

2.1 WELDING EQUIPMENT AND MATERIALS

All welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1 and AISC-04. When AWS D1.1 and the AISC-04 specification conflict, the requirements of AWS D1.1 shall govern.

3.1.2 Identification

Welds shall be identified in one of the following ways:

- a. Written records shall be submitted to indicate the location of welds made by each welder, welding operator, or tacker.
- b. Each welder, welding operator, or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. For seam welds, the identification mark shall be adjacent to the weld at 3 foot intervals. Identification with die stamps or electric etchers shall not be allowed.

3.2 QUALITY CONTROL

Testing shall be done by an approved inspection or testing laboratory or technical consultant, or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. The Contractor shall perform visual inspection to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1.

3.3 STANDARDS OF ACCEPTANCE

Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1 and the contract drawings. Nondestructive testing shall be by visual inspection methods.

3.3.1 Nondestructive Examination

The welding shall be subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop will not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

3.3.2 DESTRUCTIVE TESTS

When metallographic specimens are removed from any part of a structure, the Contractor shall make repairs. The Contractor shall employ qualified welders or welding operators, and shall use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Corrections shall be in accordance with the requirements of AWS D1.1 and the specifications. Defects shall be repaired in accordance with the approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before rewelding, the area shall be examined by suitable methods to insure that the defect has been eliminated. Repair welds shall meet the inspection requirements for the original welds. Any indication of a defect shall be regarded as a defect, unless reevaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 STORAGE

PART 2 PRODUCTS

- 2.1 STRUCTURAL STEEL
 - 2.1.1 Carbon Grade Steel
- 2.2 STRUCTURAL TUBING
- 2.3 STEEL PIPE
- 2.4 HIGH STRENGTH BOLTS AND NUTS
- 2.5 CARBON STEEL BOLTS AND NUTS
- 2.6 NUTS DIMENSIONAL STYLE
- 2.7 WASHERS
- 2.8 PAINT

PART 3 EXECUTION

- 3.1 FABRICATION
- 3.2 ERECTION
 - 3.2.1 Structural Connections
 - 3.2.2 Base Plates and Bearing Plates
 - 3.2.3 Field Priming

-- End of Section Table of Contents --

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

| | |
|----------------------|---|
| AISC ASD Manual | (1989) Manual of Steel Construction Allowable Stress Design |
| AISC ASD/LRFD Vol II | (1992) Manual of Steel Construction Vol II: Connections |
| AISC LRFD Vol II | (1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-----------------|--|
| ASTM A 36/A 36M | (1996) Carbon Structural Steel |
| ASTM A 53 | (1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A 307 | (1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength |
| ASTM A 325 | (1996) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| ASTM A 500 | (1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A 563 | (1994) Carbon and Alloy Steel Nuts |
| ASTM F 844 | (1990) Washers, Steel, Plain (Flat), Unhardened for General Use |

AMERICAN WELDING SOCIETY (AWS)

| | |
|----------|--|
| AWS A2.4 | (1993) Standard Symbols for Welding, Brazing and Nondestructive Examination |
| AWS D1.1 | (1996) Structural Welding Code - Steel |

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude.

The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual and AISC ASD/LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC ASD Manual.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Structural Steel System; GA. Structural Connections; GA.

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

SD-08 Statements

Erection; FIO.

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

SD-13 Certificates

Mill Test Reports; FIO.

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation.

Welder Qualifications; FIO.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

Fabrication; FIO.

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

SD-14 Samples

High Strength Bolts and Nuts; GA. Carbon Steel Bolts and Nuts; GA. Nuts Dimensional Style; GA. Washers; GA.

Random samples of bolts, nuts, and washers as delivered to the job site if requested, taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B.

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E, Grade B.

2.4 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325, Type 1 with carbon steel nuts conforming to ASTM A 563, Grade C.

2.5 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563, Grade A.

2.6 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325.

2.7 WASHERS

Plain washers shall conform to ASTM F 844.

2.8 PAINT

Paint shall conform to SSPC Paint 25.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with AISC ASD Manual and primed with the specified paint.

3.2 ERECTION

Erection of structural steel shall be in accordance with the applicable provisions of AISC ASD Manual.

3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05300

STEEL DECKING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 DECK UNITS
 - 2.1.1 Form Deck
- 2.2 TOUCH-UP PAINT
- 2.3 ADJUSTING PLATES
- 2.4 CLOSURE PLATES
 - 2.4.1.1 Column Closures to Close Openings
 - 2.4.1.2 Sheet Metal
- 2.5 ACCESSORIES

PART 3 EXECUTION

- 3.1 ERECTION
- 3.2 ATTACHMENTS
- 3.3 HOLES AND OPENINGS

-- End of Section Table of Contents --

SECTION 05300

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI-01 (1986; Addenda 1989) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 611 (1994) Steel, Sheet, Carbon, Cold-Rolled, Structural Quality

ASTM A 653 (1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3 (1989) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI-02 (1987; Amended 1991) Diaphragm Design Manual

SDI Pub No 28 (1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 20 (1991) Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Deck Units; FIO

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

SD-04 Drawings

Deck Units; FIOAccessories; FIO.
Attachments; FIO. Holes and Openings; FIO.

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded or fastener connections; and the manufacturer's erection instructions.

SD-13 Certificates

Deck Units; FIOAttachments; FIO

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

SD-14 Samples

Deck Units; FIO. Accessories; FIO

SD-18 Statements

Attachments; FIO

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No 28. Panels of maximum possible lengths shall be used to minimize end laps. Fabricate deck units in lengths to span 3 or more supports with flush, telescoped, or nested 2 inch laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI-01, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 653 or ASTM A 611. Deck used as a form for concrete shall be fabricated of the steel design thickness required by the design drawings, and shall be painted with one coat of manufacturer's standard paint.

2.2 TOUCH-UP PAINT

Touch-up paint for shop-painted units shall be of the same type used for the shop painting. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.4 CLOSURE PLATES

2.4.1.1 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.4.1.2 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 0.0474 inch; welding washers, 0.0598 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No 28 and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be used for storage or as a working platform until the units have been secured in position. Shoring shall be in position before concrete placement begins in composite or form deck. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum

uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

3.2 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 5/8 inch diameter puddle welds or fastened with screws to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 28. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI-02.

3.3 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0474 inch thick steel sheet at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS
- 1.4 DISSIMILAR MATERIALS
- 1.5 WORKMANSHIP
- 1.6 ANCHORAGE
- 1.7 ALUMINUM FINISHES
- 1.8 SHOP PAINTING

PART 2 PRODUCTS

- 2.1 ACCESS DOORS AND PANELS
- 2.2 CORNER GUARDS AND SHIELDS
- 2.3 DOOR GUARDS
- 2.4 PIPE GUARDS
- 2.5 FLOOR GRATINGS AND FRAMES
- 2.6 FLOOR PLATES
- 2.7 HANDRAILS
 - 2.7.1 Steel Handrails, Including Carbon Steel Inserts
- 2.8 MIRROR FRAMES
- 2.9 MISCELLANEOUS
- 2.10 STEEL STAIRS
- 2.11 STEEL DOOR FRAMES
- 2.12 TRENCH COVERS, FRAMES, AND LINERS
- 2.13 WINDOW GUARDS, BAR GRILLE TYPE
- 2.14 WINDOW SUB-SILL
- 2.15 FIXED FLOOR ATTACHED BLEACHERS

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
- 3.2 DOOR GUARD FRAME
- 3.3 INSTALLATION OF PIPE GUARDS
- 3.4 ATTACHMENT OF HANDRAILS
 - 3.4.1 Installation of Steel Handrails
- 3.5 DOOR FRAMES
- 3.6 TRENCH FRAMES AND COVERS
- 3.7 INSTALLATION OF WHEEL GUARDS
- 3.8 BAR-GRILLE WINDOW GUARDS

-- End of Section Table of Contents --

SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980; R 1993) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1996) Carbon Structural Steel

ASTM A 53 (1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 283 (1993a) Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A 500 (1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 653 (1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924 (1996a) Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM D 2047 (1993) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1994) Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (1993) Metal Bar Grating Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Miscellaneous Metal Items; GA.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates.

SD-14 Samples

Miscellaneous Metal Items; GA.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 653, or ASTM A 924, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish.

1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches and of not lighter than 14 gauge steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a baked enamel finish.

2.2 CORNER GUARDS AND SHIELDS

Corner guards and shields for jambs and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry or concrete with welded steel straps or end weld stud anchors. Corner guards for use with glazed or ceramic tile finish on walls shall be formed of 0.0625 inch thick corrosion-resisting steel with polished or satin finish, shall extend 5 feet above the top of cove base or to the top of the wainscot, whichever is less, and shall be securely anchored to the supporting wall. Corner guards on exterior shall be galvanized.

2.3 DOOR GUARDS

Door guards shall be constructed of woven steel wire or expanded metal framed with structural steel shapes. Expanded metal guards shall be of 1-1/2 inch No. 10 mesh, welded to 1 by 1 by 1/8 inch angle frame. Woven-wire panel shall be of 10 gauge, 1-1/2 inch mesh secured through weaving to 1 inch channel frame or around a 3/8 inch round bar frame. Corners of frames shall be mitered and welded. Guards shall be sized as indicated.

2.4 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53, Type E or S, weight STD, black finish.

2.5 FLOOR GRATINGS AND FRAMES

Carbon steel grating shall be designed in accordance with NAAMM MBG 531 to meet the indicated load requirements. Edges shall be banded with bars 1/4 inch less in height than bearing bars for grating sizes above 3/4 inch. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication.

2.6 FLOOR PLATES

Floor plates shall be 1/4 inch thick, raised thread steel, galvanized, slip-resistant, carbon steel conforming to ASTM A 283 having a minimum static coefficient of friction of 0.50 when tested in accordance with ASTM D 2047. Wearing surface shall be aluminum oxide or silicon carbide.

2.7 HANDRAILS

Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

2.7.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53 or structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Steel railings shall be 1-1/2 inch nominal size. Railings shall be hot-dip galvanized. Pipe collars shall be hot-dip galvanized steel.

- a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

- (1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal recessed-head setscrews.

- (2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 6 inches long.

- (3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

- b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.8 MIRROR FRAMES

Frames for plate glass mirrors larger than 18 by 30 inches shall be fabricated from corrosion-resisting steel with satin finish. Frames shall be provided with concealed fittings and tamperproof mountings.

2.9 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.10 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, grating treads, slip-resistant metallic treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to ASTM A 36. Stairs and accessories shall be galvanized. Gratings for treads and landings shall conform to NAAMM MBG 531. Grating treads shall have slip-resistant nosings.

2.11 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 2 by 1/4 by 12 inch bent, adjustable metal anchors spaced not over 2 feet 6 inches on centers. Provision shall be made to stiffen the top member for all spans over 3 feet. Continuous door stops shall be made of 1-1/2 by 5/8 inch bars.

2.12 TRENCH COVERS, FRAMES, AND LINERS

Trench covers shall be designed to meet the indicated load requirements. Trench frames and anchors shall be all welded steel construction designed to match cover. Covers shall be secured to frame and shall be cast-iron grating. Grating opening widths shall not exceed 1 inch. Trench liners shall be cast iron with integral frame for cover.

2.13 WINDOW GUARDS, BAR GRILLE TYPE

Bar grill window guards shall be of 3/4 inch round bars, spaced not over 4 inches on centers vertically, and 2 by 1/2 inch horizontal bars spaced not over 12 inches on centers. Vertical bars shall be extended through and securely welded to the cross bars. Horizontal bars shall be extended, bent, and drilled as shown for anchorage at jambs of window openings.

2.14 WINDOW SUB-SILL

Window sub-sill shall be of extruded aluminum alloy of size and design indicated. Not less than two anchors per window section shall be provided for securing into mortar joints of masonry sill course. Sills for banks of windows shall have standard mill finish with a protective coating, prior to shipment, of two coats of a clear, colorless, methacrylate lacquer applied to all surfaces of the sills.

2.15 FIXED FLOOR ATTACHED BLEACHERS

Bleachers shall be of length and number of rows as indicated on drawings. Bleachers shall be fixed type. Row span shall be as indicated on drawings. Riser height shall be as indicated on drawings.

Bleacher understructure shall be constructed of electric-welded continuous closed seam rectangular aluminum tubing. Support framing shall be manufacturer's standard assembly. Bleacher seats and risers shall be aluminum with a non-slip formed surface.

Bleachers shall comply with the requirements of NFPA 102. Bleachers shall be warranted for a period of one year from date of installation.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 DOOR GUARD FRAME

Door guard frame shall be mounted over the glazed opening using 1/4 inch lag bolts on the interior of wood doors or tamperproof through bolts on the interior of metal doors.

3.3 INSTALLATION OF PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 3000 psi.

3.4 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

3.4.1 Installation of Steel Handrails

Installation shall be in pipe sleeves embedded in concrete and filled with molten lead or sulphur with anchorage covered with standard pipe collar pinned to post or base plates bolted to stringers or structural steel framework. Rail ends shall be secured by steel pipe flanges anchored by expansion shields and bolts.

3.5 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 18 inch centers, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

3.6 TRENCH FRAMES AND COVERS

Trench frames and covers shall finish flush with the floor.

3.7 INSTALLATION OF WHEEL GUARDS

Wheel guards shall be filled with concrete and anchored to the floor or the building according to the manufacturer's recommendations.

3.8 BAR-GRILLE WINDOW GUARDS

Bar-grille window guards shall be securely anchored to masonry with 1/2

inch diameter prison-type screws or bolts and expansion shields, or other type of fastenings if the ends of such fastenings are welded to the adjoining metal grilles or otherwise made tamperproof in a satisfactory manner. Spanner-head screws or bolts are not considered prison-type fasteners.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 06 - WOODS & PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 LUMBER AND SHEATHING
 - 2.1.1 Grading and Marking
 - 2.1.1.1 Lumber Products
 - 2.1.1.2 Fabricated Structural Members
 - 2.1.1.3 Plywood and other Sheathing Products
 - 2.1.2 Sizes
 - 2.1.3 Treatment
 - 2.1.3.1 Lumber and Timbers
 - 2.1.3.2 Plywood
 - 2.1.4 Moisture Content
 - 2.1.5 Structural Wood Members
 - 2.1.5.1 Trussed Rafters
 - 2.1.6 Sheathing
 - 2.1.6.1 Plywood
 - 2.1.7 Subflooring
 - 2.1.7.1 Plywood
 - 2.1.8 Miscellaneous Wood Members
 - 2.1.8.1 Nonstress Graded Members
 - 2.1.8.2 Wood Bumpers
 - 2.1.8.3 Sill Plates
 - 2.1.8.4 Blocking
 - 2.1.8.5 Rough Bucks and Frames
- 2.2 ACCESSORIES AND NAILS
 - 2.2.1 Anchor Bolts
 - 2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws
 - 2.2.3 Clip Angles
 - 2.2.4 Expansion Shields
 - 2.2.5 Joist Hangers
 - 2.2.6 Metal Bridging
 - 2.2.7 Nails and Staples
- 2.3 INSULATION
 - 2.3.1 Batt or Blanket
 - 2.3.1.1 Glass Fiber Batts and Rolls
 - 2.3.2 Loose Fill or Granular Fill
 - 2.3.2.1 Vermiculite
 - 2.3.2.2 Perlite
 - 2.3.3 Sill Sealer
 - 2.3.4 Rigid Insulation

- 2.3.4.1 Polystyrene Board
- 2.4 VAPOR RETARDER

PART 3 EXECUTION

- 3.1 INSTALLATION OF FRAMING
 - 3.1.1 General
 - 3.1.2 Structural Members
 - 3.1.3 Partition and Wall Framing
 - 3.1.4 Floor (Ceiling) Framing
 - 3.1.5 Roof Framing or Rafters
 - 3.1.6 Stair Framing
- 3.2 INSTALLATION OF SHEATHING
 - 3.2.1 Plywood
- 3.3 INSTALLATION OF SUBFLOORING
 - 3.3.1 Plywood
- 3.4 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS
 - 3.4.1 Bridging
 - 3.4.2 Corner Bracing
 - 3.4.3 Blocking
 - 3.4.4 Nailers and Nailing Strips
 - 3.4.5 Wood Grounds
 - 3.4.6 Furring Strips
 - 3.4.7 Rough Bucks and Frames
 - 3.4.8 Wood Bumpers
 - 3.4.9 Sill Plates
- 3.5 INSTALLATION OF TIMBER CONNECTORS
- 3.6 INSTALLATION OF INSULATION
- 3.7 INSTALLATION OF VAPOR RETARDER

-- End of Section Table of Contents --

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN FOREST AND PAPER ASSOCIATION (AFPA)

- AFPA-T901 (1991; Supple 1993; Addenda Apr 95)
National Design Specification for Wood
Construction
- AFPA T11-WCD1 (1988) Manual for Wood Frame Construction

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

- AITC 111 (1979) Recommended Practice for Protection
of Structural Glued Laminated Timber
During Transit, Storage and Erection
- AITC ANSI/AITC-190.1 (1992) Wood Products - Structural Glued
Laminated Timber

APA-THE ENGINEERED WOOD ASSOCIATION (APA)

- APA Form E30 (1996) Design/Construction Guide,
Residential and Commercial
- APA E445 (1991; Rev Jan 1996) Performance Standards
and Policies for Structural-Use Panels
- APA EWS R540 (1996) Proper Storage and Handling of
Glulam Beams
- APA V450 (1994; Rev Apr 1996) Source List -
Adhesives for APA Glued Floor System

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 307 (1994) Carbon Steel Bolts and Studs, 60
000 PSI Tensile Strength
- ASTM C 516 (1980; R 1990) Vermiculite Loose Fill
Thermal Insulation
- ASTM C 518 (1991) Steady-State Heat Flux Measurements
and Thermal Transmission Properties By
Means of the Heat Flow Meter Apparatus

| | |
|------------|--|
| ASTM C 549 | (1981; R 1995) Perlite Loose Fill Insulation |
| ASTM C 578 | (1995) Rigid, Cellular Polystyrene Thermal Insulation |
| ASTM C 665 | (1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing |
| ASTM E 84 | (1996a) Surface Burning Characteristics of Building Materials |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |
| ASTM E 154 | (1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover |
| ASTM F 547 | (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials |

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

| | |
|---------|---|
| AWPA C2 | (1995) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes |
| AWPA C9 | (1995) Plywood - Preservative Treatment by Pressure Processes |
| AWPA M4 | (1995) Standard for the Care of Preservative-Treated Wood Products |
| AWPA P5 | (1996) Standards for Waterborne Preservatives |

CALIFORNIA REDWOOD ASSOCIATION (CRA)

| | |
|--------|--|
| CRA-01 | (1995) Standard Specifications for Grades of California Redwood Lumber |
|--------|--|

DEPARTMENT OF COMMERCE (DOC)

| | |
|----------|---|
| DOC PS 1 | (1996) Voluntary Product Standard - Construction and Industrial Plywood |
| DOC PS 2 | (1992) Performance Standards for Wood-Based Structural-Use Panels |

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

| | |
|-----------|--|
| FM P7825c | (1997) Approval Guide Building Materials |
|-----------|--|

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

| | |
|---|--|
| NHLA-01 | (1994) Rules for the Measurement & Inspection of Hardwood & Cypress |
| NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA) | |
| NELMA-01 | (1993) Standard Grading Rules for Northeastern Lumber |
| SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA) | |
| SCMA-01 | (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress |
| SOUTHERN PINE INSPECTION BUREAU (SPIB) | |
| SPIB-1001 | (1994) Standard Grading Rules for Southern Pine Lumber |
| TRUSS PLATE INSTITUTE (TPI) | |
| TPI 1 | (1995) National Design Standard for Metal Plate-Connected Wood Truss Construction and Commentary and Appendices to TPI 1 |
| WEST COAST LUMBER INSPECTION BUREAU (WCLIB) | |
| WCLIB Std 17 | (1993) Supples III (A), V (A), & VI (A)) Grading Rules for West Coast Lumber |
| WESTERN WOOD PRODUCTS ASSOCIATION (WWPA) | |
| WWPA-01 | (1995; Supple Nos. 1, 2, and 3) Western Lumber Grading Rules 95 |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Structural Wood Members; GA.

Design analysis and calculations of structural laminated members, fabricated wood trusses, and other fabricated structural members showing design criteria used to accomplish the applicable analysis.

SD-04 Drawings

Structural Wood Members; GA.

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

SD-13 Certificates

Grading and Marking; GA.

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

Insulation; GA.

Certificate attesting that the cellulose, perlite, glass and mineral fiber, polyurethane, or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or grademark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

2.1.1.2 Fabricated Structural Members

Wood trusses shall be fabricated in accordance with TPI 1. Laminated timbers shall be marked with a quality mark indicating conformance to AITC ANSI/AITC-190.1. Engineered wood joists and rafters shall be fabricated using an approved quality control system to meet specified requirements.

2.1.1.3 Plywood and other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and structural-use panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall

be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

- a. Wood members in contact with or within 18 inches of soil.
- b. Wood members in contact with water.
- c. Wood members exposed to the weather including those used in builtup roofing systems or as nailing strips or nailers over fiberboard or gypsum-board wall sheathing as a base for wood siding.
- d. Wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.
- e. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

2.1.3.1 Lumber and Timbers

Lumber and timbers shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use.

2.1.3.2 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use.

2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

- a. Treated and Untreated Lumber Except Roof Planking: 4 inches or less, nominal thickness, 19 percent maximum. 5 inches or more, nominal thickness, 23 percent maximum in a 3 inch perimeter of the timber cross-section.
- b. Roof Planking: 15 percent maximum.
- c. Materials Other Than Lumber: In accordance with standard under

which product is produced.

2.1.5 Structural Wood Members

2.1.5.1 Trussed Rafters

As an option to standard rafters, trussed rafters may be provided. The design shall be as indicated. Connections shall be made with light-metal plate-connectors. Light-metal-plate-connected wood trusses shall be designed and fabricated in conformance with TPI 1. When new plate configuration is proposed, load testing of trusses is required and shall conform to Appendix D of TPI 1.

2.1.6 Sheathing

Sheathing shall be plywood for wall sheathing; and plywood for roof sheathing.

2.1.6.1 Plywood

Plywood shall conform to DOC PS 1, APA E445 or DOC PS 2, Grade C-D with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.

2.1.7 Subflooring

2.1.7.1 Plywood

Plywood shall conform to DOC PS 1, APA E445 or DOC PS 2; Grade C-D with exterior glue for uses not otherwise specified; Grade C-D with exterior glue for reception of underlayment or wood flooring; underlayment grade with exterior glue, or C-C (plugged) exterior grade for use as a combination subfloor-underlayment under resilient flooring. Minimum span rating for subflooring shall be 24/16 for supports 16 inches on center, and 48/24 for supports 24 inches on center. Minimum span rating for combination subfloor-underlayment shall be 16/0 for supports 16 inches on center and 24/0 for supports at 24 inches on center.

2.1.8 Miscellaneous Wood Members

2.1.8.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

| Member | Size (inch) |
|----------------|--|
| Bridging | 1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12. |
| Corner bracing | 1 x 4. |
| Furring | 1 x 3. |

| Member | Size (inch) |
|----------------|--|
| Grounds | Plaster thickness by 1-1/2. |
| Nailing strips | 1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock. |

2.1.8.2 Wood Bumpers

Bumpers shall be of the species and grade in accordance with TABLE II at the end of this section, size as shown.

2.1.8.3 Sill Plates

Sill plates shall be standard or number 2 grade.

2.1.8.4 Blocking

Blocking shall be standard or number 2 grade.

2.1.8.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

2.2.3 Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.2.4 Expansion Shields

Type and size best suited for intended use.

2.2.5 Joist Hangers

Steel or iron, zinc-coated, size to fit members where used, sufficient strength to develop the full strength of supported member, complete with any special nails required.

2.2.6 Metal Bridging

Optional to wood bridging; zinc-coated steel, size and design to provide rigidity equivalent to specified wood bridging.

2.2.7 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AFPA T11-WCD1. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AFPA-T901. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.3 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown.

R-values shall be determined at 75 degrees F in accordance with ASTM C 518.

Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.3.1 Batt or Blanket

2.3.1.1 Glass Fiber Batts and Rolls

Glass fiber batts and rolls shall conform to ASTM C 665, Type II kraft faced insulation, Class C, having a UL rating of 50 and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84. Width and length shall suit construction conditions.

2.3.2 Loose Fill or Granular Fill

2.3.2.1 Vermiculite

Vermiculite shall conform to ASTM C 516, Type II.

2.3.2.2 Perlite

Perlite shall conform to ASTM C 549, Type II with minimum recovered material content of 23 percent by weight of core material.

2.3.3 Sill Sealer

Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I.

2.3.4 Rigid Insulation

2.3.4.1 Polystyrene Board

Polystyrene board shall be extruded and conform to ASTM C 578, Type IV.

2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 0.5 perms as determined in accordance with ASTM E 96, unless otherwise specified.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Members shall be framed for passage of ducts. Members shall be cut, notched, or bored in accordance with applicable requirements of AFPA-T901 for the passage of pipes, wires, or conduits. Rafters, purlins, and joists shall be set with crown edge up. Framing shall be kept at least 2 inches away from chimneys and 4 inches away from fireplace backwalls. When joists, beams, and girders are placed on masonry or concrete, a wood base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket shall be formed into the wall. The joist, beam, or girder shall then be placed into the pocket and leveled with a steel shim.

3.1.2 Structural Members

Members shall be adequately braced before erection. Members shall be aligned and all connections completed before removal of bracing. Individually wrapped members shall be unwrapped only after adequate protection by a roof or other cover has been provided. Scratches and abrasions of factory-applied sealer shall be treated with two brush coats of the same sealer used at the factory.

3.1.3 Partition and Wall Framing

Unless otherwise shown, studs shall be spaced 16 inches on centers. Studs shall be doubled at openings. Unless otherwise indicated, headers for openings shall be made of two pieces of stud material set on edge or solid lumber of equivalent size, and corners shall be constructed of not less than three full members. End studs of partitions abutting concrete or masonry shall be anchored thereto with expansion bolts, one near each end of each stud and at intermediate intervals of not more than 4 feet. Plates of partitions resting on concrete floors shall be anchored in place with expansion bolts, one near each end of each piece and at intermediate intervals of not more than 6 feet between bolts. In lieu of expansion bolts, anchoring into concrete may be accomplished with powder-driven threaded studs of suitable type and size and spaced at 3 feet on center. Walls and load bearing partitions shall be provided with double top plates with members lapped at least 2 feet and well spiked together.

3.1.4 Floor (Ceiling) Framing

Except where otherwise indicated joists shall have bearings not less than 4 inches on concrete or masonry and 1-1/2 inches on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels shall be carried on joist hangers. Joists shall be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors shall be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist shall be doubled, unless otherwise indicated. Joists shall be doubled under partitions parallel with floor joists. Engineered wood joists shall be installed in accordance with distributor's instructions.

3.1.5 Roof Framing or Rafters

Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be spiked to wall plate and to ceiling joists with no less than three 8-penny nails. Rafters shall be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 4 feet and well spiked together. Trussed rafters shall be installed in accordance with TPI 1. Engineered wood joists shall be installed in accordance with distributor's instructions.

3.1.6 Stair Framing

Stair framing members shall be well spiked together. Rough carriages shall be cut to exact shape required to receive finish treads and risers. Risers shall be of uniform height, and treads shall be of uniform width except as otherwise shown. Trimmers, blocking, and other framing necessary for support of finish treads, risers, newels, and railing shall be provided.

3.2 INSTALLATION OF SHEATHING

3.2.1 Plywood

Sheathing shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center unless otherwise shown. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.3 INSTALLATION OF SUBFLOORING

3.3.1 Plywood

Subflooring shall be applied with long dimension at right angles to the supports, with edges 1/8 inch apart at side and end joints, and nailed at supported edges 6 inches on center and at intermediate supports 12 inches on center unless otherwise shown. Subflooring may be installed with adhesive conforming to APA V450 and nails spaced at 12 inches on center unless otherwise shown. Installation of subflooring with adhesives shall be in accordance with APA Form E30. Each panel shall have end joints made over supports and end joints staggered. Where finish flooring of different thicknesses is used in adjoining areas, wood strips of the thickness required to bring the finish flooring surfaces into the same plane shall be used under the plywood subfloor.

3.4 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.4.1 Bridging

Wood bridging shall have ends accurately bevel-cut to afford firm contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.4.2 Corner Bracing

Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.4.3 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 8 feet for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.4.4 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 18 inches on center and staggered. Beginning and ending nails shall not be more than 6 inches for nailer end. Ends of stacked nailers shall be offset approximately 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to FM P7825c.

3.4.5 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as

practicable, butt jointed, and rigidly secured in place.

3.4.6 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 16 inches on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

3.4.7 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 3 feet. Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 3/16 x 1-1/4 inch steel straps extending not less than 8 inches into the masonry and turned down 2 inches into the masonry.

3.4.8 Wood Bumpers

Wood bumpers shall be bored, countersunk and securely bolted in place.

3.4.9 Sill Plates

Sill plates shall be set level and square and anchor bolted at not more than 6 feet on centers and not more than 12 inches from end of each piece. A minimum of two anchors shall be used for each piece.

3.5 INSTALLATION OF TIMBER CONNECTORS

Installation of timber connectors shall conform to applicable requirements of AFPA-T901.

3.6 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.7 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

| Grading Rules | Species | Const Standard | No. 2 Comm | No. 2 Board Comm | No. 3 Comm |
|------------------|---------|-------------------|---------------|---------------------|---------------|
|------------------|---------|-------------------|---------------|---------------------|---------------|

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

| Grading Rules | Species | Const Standard | No. 2 Comm | No. 2 Board Comm | No. 3 Comm |
|---------------|--------------------------|----------------|------------|------------------|------------|
| NHLA-01 | Cypress | | | X | |
| NELMA-01 | Northern White Cedar | | | | X |
| | Eastern White Pine | X | | | |
| | Northern Pine | X | | | |
| | Balsam Fir | | | | X |
| | Eastern Hemlock-Tamarack | | | | X |
| CRA-01 | Redwood | | X | | |
| SCMA-01 | Cypress | | | X | |
| SPIB-1001 | Southern Pine | | X | | |
| WCLIB Std 17 | Douglas Fir-Larch | X | | | |
| | Hem-Fir | X | | | |
| | Sitka Spruce | X | | | |
| | Mountain Hemlock | X | | | |
| | Western Cedar | X | | | |
| WWPA-01 | Douglas Fir-Larch | X | | | |
| | Hem-Fir | X | | | |
| | Idaho White Pine | X | | | |
| | Lodgepole Pine | | | X | |
| | Ponderosa Pine | | | X | |
| | Sugar Pine | | | X | |
| | Englemann Spruce | | | X | |
| | Douglas Fir South | | | X | |
| | Mountain Hemlock | | | X | |
| | Subalpine Fir | | | X | |
| | Western Cedar | | | X | |

TABLE II. SPECIES AND GRADE

Wood Bumpers

| Grading Rules | Species | No. 1 | No. 2 |
|---------------|---------|-------|-------|
| NHLA-01 | Red Oak | X | |
| NELMA-01 | | | |

TABLE II. SPECIES AND GRADE

| Wood Bumpers | | | |
|----------------------|-------------------|-------|-------|
| Grading Rules | Species | No. 1 | No. 2 |
| | Northern Pine | | X |
| | Eastern Hemlock- | | X |
| | Tamarack | | |
| SPIB-1001 | Southern Pine | X | |
| WCLIB Std 17 | Douglas Fir-Larch | | X |
| | Hem-Fir | | X |
| WWPA-01 | Douglas Fir-Larch | | X |
| | Hem-Fir | | X |
| | Douglas Fir-South | | X |
| -- End of Section -- | | | |

SECTION TABLE OF CONTENTS

DIVISION 06 - WOODS & PLASTICS

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 WOOD ITEMS AND TRIM
 - 2.1.1 Grading and Marking
 - 2.1.2 Sizes and Patterns
 - 2.1.3 Moisture Content
 - 2.1.4 Preservative Treatment
 - 2.1.4.1 Exterior Wood Molding and Millwork
 - 2.1.5 Siding
 - 2.1.5.1 Wood Siding
 - 2.1.6 Soffits
 - 2.1.6.1 Plywood
 - 2.1.7 Fascias and Trim
 - 2.1.7.1 Wood
 - 2.1.7.2 Vinyl
 - 2.1.8 Moldings
 - 2.1.9 Woodwork Items
 - 2.1.9.1 Bulletin Boards
 - 2.1.9.2 Chalkboards
 - 2.1.9.3 Utility Shelving
 - 2.1.10 Tent Pad Siding
- 2.2 NAILS

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Installation of Siding
 - 3.1.2 Horizontal Siding
- 3.2 SOFFITS
 - 3.2.1 Wood
 - 3.2.2 Vinyl
- 3.3 FASCIAS AND EXTERIOR TRIM
- 3.4 MOLDING AND INTERIOR TRIM
- 3.5 WOODWORK ITEMS
 - 3.5.1 Bulletin Boards and Chalkboards
 - 3.5.2 Shelving
 - 3.5.3 Clothes Hanger Rods

-- End of Section Table of Contents --

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 547 (1977; R 1990) Definitions of Terms
Relating to Nails for Use with Wood and
Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA M4 (1995) Standard for the Care of
Preservative-Treated Wood Products

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01 (1995) Standard Specifications for Grades
of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -
Construction and Industrial Plywood

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1993) Standard Grading Rules for
Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURER'S ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard
Specifications for Grades of Southern
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001 (1994) Standard Grading Rules for Southern
Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1993; Supples III (A), V (A), & VI (A))
Grading Rules For West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1995; Supple Nos. 1, 2, and 3) Western
Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMPMA)

WMPMA WM 6 (1987) Industry Standard for Non-Pressure
Treating of Wood Millwork

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Wood Items, Siding, and Trim; GA
Manufacturer's printed data indicating the usage of engineered or recycled wood products, and environmentally safe preservatives.

SD-04 Drawings

Finish Carpentry; GA

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), or recycled wood products, and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, structural-use panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Preservative Treatment

2.1.4.1 Exterior Wood Molding and Millwork

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.1.5 Siding

Horizontal siding shall be hardboard, plywood, structural-use panel, wood or vinyl. Panel siding shall be hardboard, structural-use panel, or plywood.

2.1.5.1 Wood Siding

Wood siding shall be of the species and grades listed in TABLE I at the end of this section. Siding shall be horizontal bevel type, minimum 3/16 inch thin edge by minimum 7/16 inch thick edge, 1 inch thick, 6 inches wide, maximum practicable lengths, rough-sawn texture face.

2.1.6 Soffits

2.1.6.1 Plywood

Hardboard and plywood soffits shall be plywood, DOC PS 1, exterior type, Grade A-C, 11/32 inch thick for 24 inch on centers maximum span with all edges supported.

2.1.7 Fascias and Trim

2.1.7.1 Wood

Fascias and trim, including exterior door and window casing, shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated. Metal corners may be furnished in lieu of wood cornerboards for horizontal siding; and if furnished, shall be galvanized steel and primed or aluminum and primed.

2.1.7.2 Vinyl

Vinyl trim, including exterior door and window casing and moldings, shall meet the pertinent requirements specified for vinyl siding and soffits.

2.1.8 Moldings

Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

2.1.9 Woodwork Items

2.1.9.1 Bulletin Boards

Bulletin boards shall have a hardwood or aluminum frame, 1/4 inch thick plywood or hardboard back; and a 1/4 inch thick, dense, smooth faced corkboard face securely cemented to the back.

2.1.9.2 Chalkboards

Chalkboards shall have a hardwood or aluminum frame and 1/4 inch thick writing surface of porcelain enamel laminated to plywood. Color shall be green.

2.1.9.3 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA-01, 1 inch thick; or plywood, interior type, Grade A-B, 1/2 inch thick, any species group.

2.1.10 Tent Pad Siding

Exterior siding shall be CRA-RIS grade marked redwood, clear vertical grain, certified kiln dried, 3/4" x 6" rabbeted bevel, saw-textured on the exposed face.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation of Siding

Siding shall be accurately fitted and positioned without springing or otherwise forcing siding in place. Siding to have a paint finish shall have nails driven flush.

3.1.2 Horizontal Siding

End joints shall be made over framing members and be so alternated that at

least two boards will be between joints on the same support. Shorter pieces shall be uniformly distributed throughout each area. Starter strips shall be provided as necessary to establish proper slant for siding. Ends of siding shall be predrilled if necessary to prevent splitting when nailed. Horizontal bevel or plain lapsiding shall be overlapped and nailed into each support in accordance with approved recommendations of the siding manufacturer. Vinyl siding shall be fastened to a starter strip at the locking hem. Each subsequent course shall be interlocked at the locking hem to the adjoining panel and nailed to the substrate on the nailing flange. Nails shall be placed at the center of the slots on the nailing flange, and loosely nailed to allow movement in the panel.

3.2 SOFFITS

3.2.1 Wood

Panels shall be applied with edges at joints spaced in accordance with manufacturer's instructions and with all edges backed with framing members. Panels shall be nailed $3/8$ inch from edges at 6 inches on center and at intermediate supports at 12 inches on center. Panels shall be installed using the maximum practical lengths.

3.2.2 Vinyl

Vinyl soffits shall rest in a "j" channel at each end of the soffit panel. Each panel shall be interlocked at the locking hem and nailed to a support at the nailing flange. Nails shall be placed at the center of the slots on the nailing flange, and loosely nailed to allow movement in the panel.

3.3 FASCIAS AND EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Fascias and other flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.5 WOODWORK ITEMS

3.5.1 Bulletin Boards and Chalkboards

Items shall be installed in accordance with the manufacturer's recommendation.

3.5.2 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 24 inches on center.

3.5.3 Clothes Hanger Rods

Rods shall be provided where indicated and in all closets having hook strips. Rods shall be zinc-coated steel pipe 1 inch in diameter. Rods shall be set parallel with the front edges of the shelving, and shall be supported at each end by suitable sockets, and by intermediate brackets spaced at not more than 4 footcenters.

TABLE I. SPECIES AND GRADE TABLES

| Grading Rules | Species | Choice | Clear | C Select | C & Better |
|------------------|-------------------|--------|-------|----------|---------------|
| NELMA-01 | Eastern Cedar | | X | | |
| | Eastern Hemlock | | X | | |
| | Tamarack | | | | X |
| | Eastern W. Pine | | | | X |
| | Northern Pine | | | | X |
| | Eastern Spruce | | | X | |
| | Balsam Fir | | X | | |
| CRA-01 | Redwood | | X | | |
| SCMA-01 | Cypress | | | X | |
| SPIB-1001 | Southern Pine | | | | X |
| WCLIB Std 17 | Douglas Fir | | | | X |
| | Larch | | | | X |
| | Hemlock Fir | | | | X |
| | Mountain Hemlock | | | | X |
| | Sitka Spruce | | | | X |
| WWPA-01 | Douglas Fir | | | X | |
| | Larch | | | | X |
| | Hemlock Fir | | X | | |
| | Mountain Hemlock | | | | X |
| | Western Larch | | X | | |
| | Idaho White Pine | X | | | |
| | Lodgepole Pine | | X | | |
| | Ponderosa Pine | | X | | |
| | Sugar Pine | | X | | |
| | Englemann Spruce | | X | | |
| | Douglas Fir South | | X | | |
| | Subalpine Fir | | X | | |

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA-01, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07311

ROOFING, STRIP SHINGLES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE OF MATERIALS
- 1.4 WARRANTY

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Metal Drip Edges
 - 2.1.2 Underlayment
 - 2.1.3 Nails
 - 2.1.4 Shingles
- 2.2 COLOR

PART 3 EXECUTION

- 3.1 PREPARATION OF SURFACES
- 3.2 APPLICATION OF ROOFING
 - 3.2.1 Flashings
 - 3.2.2 Metal Drip Edges
 - 3.2.3 Underlayment
 - 3.2.4 Shingles

-- End of Section Table of Contents --

SECTION 07311

ROOFING, STRIP SHINGLES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM D 226 | (1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |
| ASTM D 3018 | (1990; R 1994) Class A Asphalt Shingles Surfaced With Mineral Granules |
| ASTM D 3161 | (1995) Wind-Resistance of Asphalt Shingles (Fan-Induced Method) |
| ASTM D 3462 | (1993a) Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Roofing System; GA

Manufacturer's catalog data, description of underlayment, shingles, fasteners, and flashing. Manufacturer's instructions, annotated or supplemented by the Contractor to indicate configuration and method for installing the underlayment, shingles, and flashing, and for waterproofing of joints where flashings change direction. The number, spacing and orientation of fasteners shall be specified.

SD-14 Samples

Finishes; GA.

Samples of materials and products requiring color or finish selection.

1.3 DELIVERY AND STORAGE OF MATERIALS

Materials shall be delivered in manufacturer's unopened bundles and containers with the manufacturer's brand and name marked clearly thereon. Shingles shall be stored in accordance with manufacturer's printed

instructions. Roll goods shall be stored on end in an upright position. Immediately before laying, roofing felt shall be stored for 24 hours in an area maintained at a temperature not lower than 50 degrees F.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following requirements:

2.1.1 Metal Drip Edges

Metal drip edges shall be minimum 28 gauge galvanized steel or an equivalent non-corrosive non-staining material.

2.1.2 Underlayment

Organic felt; ASTM D 226, Type I.

2.1.3 Nails

In accordance with manufacturer's printed instructions.

2.1.4 Shingles

Shingles shall be approximately 12 by 36 inches in dimension and architectural design. Shingles shall have self-sealing adhesive strips and shall meet a wind velocity rating of 60 mph plus or minus 5 percent in accordance with ASTM D 3161. Shingles shall be fungus resistant. Glass felt shingles shall comply with ASTM D 3018 and ASTM D 3462 Type I, Class A and shall weigh not less than 320 lbs..

2.2 COLOR

Shingle color shall be selected by Contracting Officer from manufacturer's standard colors. Color selection shall not be limited to less than eight (8) colors minimum whether colors represented are standard or non-standard.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

The construction of any bay or section of roof decking shall be completed before roofing work is started. Roof surfaces shall be smooth, firm, dry, and free from loose boards, large cracks, and projecting ends that might damage the roofing. Vents and other projections through roofs shall be properly flashed and secured in position, and projecting nails shall be driven firmly home.

3.2 APPLICATION OF ROOFING

3.2.1 Flashings

Metal flashings shall conform to Section 07600 SHEET METALWORK, GENERAL.

Metal flashings shall be provided at the intersections of roofs and adjoining walls and at projections through the deck such as chimneys and vent stacks. Valley flashing may be of the open, closed cut, or woven type.

3.2.2 Metal Drip Edges

Metal drip edges shall be provided along the eaves and rakes. The metal drip edge shall be applied directly over the underlayment along the rakes and directly on the wood deck at the eaves. Metal drip edges shall extend back from the edge of the deck not less than 3 inches and shall be secured with compatible nails spaced not more than 10 inches on center along the inner edge.

3.2.3 Underlayment

Before any shingles are applied, a single layer of asphalt-saturated-felt underlayment shall be applied to the roof deck sheathing. In areas subject to ice damming, two plies of organic felt set in hot asphalt, or an adhered modified bitumen membrane underlayment shall be applied starting from the eaves to a point 24 inches inside the inside wall line.

3.2.4 Shingles

Shingles shall be applied in accordance with the manufacturer's printed instructions as they appear on the bundle wrapping.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Manufacturer
 - 1.2.2 Installer
- 1.3 DESIGN REQUIREMENTS
 - 1.3.1 Design Criteria
 - 1.3.2 Dead Loads
 - 1.3.3 Live Loads
 - 1.3.3.1 Concentrated Loads
 - 1.3.3.2 Uniform Loads
 - 1.3.4 Roof Snow Loads
 - 1.3.5 Wind Loads
 - 1.3.6 Thermal Loads
 - 1.3.7 Roof Panels Design
 - 1.3.8 Accessories and Their Fasteners
- 1.4 PERFORMANCE REQUIREMENTS
- 1.5 SUBMITTALS
- 1.6 DELIVERY AND STORAGE
- 1.7 WARRANTIES
 - 1.7.1 Contractor's Weathertightness Warranty
 - 1.7.2 Manufacturer's Material Warranties.

PART 2 PRODUCTS

- 2.1 ROOF PANELS
 - 2.1.1 Steel Panels
- 2.2 CONCEALED ANCHOR CLIPS
- 2.3 ACCESSORIES
- 2.4 FASTENERS
 - 2.4.1 Screws
 - 2.4.2 Bolts
 - 2.4.3 Structural Blind Fasteners
- 2.5 FACTORY COLOR FINISH
 - 2.5.1 Salt Spray Test
 - 2.5.2 Formability Test
 - 2.5.3 Accelerated Weathering, Chalking Resistance and Color Change
 - 2.5.4 Humidity Test
 - 2.5.5 Impact Resistance
 - 2.5.6 Abrasion Resistance Test
 - 2.5.7 Pollution Resistance
- 2.6 INSULATION
 - 2.6.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck
 - 2.6.2 Blanket Insulation

- 2.7 INSULATION RETAINERS
- 2.8 SEALANT
- 2.9 GASKETS AND INSULATING COMPOUNDS
- 2.10 VAPOR RETARDER
 - 2.10.1 Vapor Retarders as Integral Facing

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Field Forming of Panels
 - 3.1.2 Roof Panel Installation
 - 3.1.3 Concealed Anchor Clips
- 3.2 INSULATION INSTALLATION
 - 3.2.1 Board Insulation with Blanket Insulation
 - 3.2.2 Blanket Insulation
- 3.3 CLEANING AND TOUCH-UP

-- End of Section Table of Contents --

SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA-02 (1994) Aluminum Design Manual:
Specifications and Guidelines for Aluminum
Structures

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI-01 (1986; Addenda 1989) Cold-Formed Steel
Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463 (1996a) Steel Sheet, Aluminum-Coated, by
the Hot-Dip Process

ASTM A 653 (1996) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process

ASTM A 792 (1995) Steel Sheet, 55% Aluminum-Zinc
Alloy-Coated by the Hot-Dip Process

ASTM B 117 (1994) Operating Salt Spray (Fog) Testing
Apparatus

ASTM C 518 (1991) Steady-State Heat Flux Measurements
and Thermal Transmission Properties by
Means of the Heat Flow Meter Apparatus

ASTM C 991 (1992) Flexible Glass Fiber Insulation for
Pre-Engineered Metal Buildings

ASTM C 1289 (1995) Faced Rigid Cellular
Polyisocyanurate Thermal Insulation Board

ASTM D 522 (1993a) Mandrel Bend Test of Attached
Organic Coatings

ASTM D 714 (1987; R 1994) Evaluating Degree of
Blistering of Paints

ASTM D 968 (1993) Abrasion Resistance of Organic

Coatings by Falling Abrasive

| | |
|-------------|---|
| ASTM D 1308 | (1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes |
| ASTM D 1654 | (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments |
| ASTM D 2244 | (1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates |
| ASTM D 2247 | (1994) Testing Water Resistance of Coatings in 100% Relative Humidity |
| ASTM D 2794 | (1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) |
| ASTM D 3359 | (1995) Measuring Adhesion by Tape Test |
| ASTM D 4214 | (1989) Evaluating the Degree of Chalking of Exterior Paint Films |
| ASTM D 4587 | (1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus |
| ASTM E 84 | (1996a) Surface Burning Characteristics of Building Materials |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |
| ASTM E 1592 | (1995) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference |

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

| | |
|---------|---|
| MBMA-01 | (1996) Low Rise Building Systems Manual |
|---------|---|

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a manufacturer's standard product which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.2.2 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same manufacturer.

1.3.1 Design Criteria

Design criteria shall be in accordance with MBMA-01 unless otherwise specified.

1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 300 pound concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 20 psf.

1.3.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

1.3.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

a. Single fastener in each connection.....3.0

b. Two or more fasteners in each connection...2.25

1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 240 degrees F during the life of the structure.

1.3.7 Roof Panels Design

Steel panels shall be designed in accordance with AISI-01. Aluminum panels shall be designed in accordance with AA-02. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.8 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 3/8 inch will be allowed when the supporting structural members are prepunched or predrilled.

1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 30 inches. Test 2 shall simulate the interior condition with both ends free of crosswise restraint.

The maximum span length for the interior condition shall be 5.0 feet. External reinforcement, such as clamps on the ribs, may be installed to improve uplift resistance. Bolts through seams shall not be installed.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Design Analysis; GA.

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

SD-04 Drawings

Structural Standing Seam Metal Roof System; GA.

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

SD-08 Statements

Qualifications; GA

Qualifications of the manufacturer and installer.

SD-09 Reports

Test Report for Uplift Resistance of the SSSMR; GA.

The report shall include the following information:

- a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.
- b. Details of the anchor clip, dimensions, and thickness.
- c. Type of fasteners, size, and the number required for each connection.
- d. Purlins/subpurlins size and spacing used in the test.
- e. Description of the seaming operation including equipment used.
- f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.
- g. Any additional information required to identify the SSSMR system tested.
- h. Signature and seal of an independent registered engineer who witnessed the test.

SD-13 Certificates

Structural Standing Seam Metal Roof System; GA

- a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.
- b. Certification that materials used in the installation are mill certified.

- c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.
- d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.
- e. Certification of installer.
- f. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties.

Insulation; GA

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

SD-14 Samples

Accessories; FIO

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; FIO

One piece of each type to be used, 9 inches long, full width.

Factory Color Finish; GA

Three 3 by 5 inches samples of each type and color.

Fasteners; GA

Two samples of each type to be used, with statement regarding intended use.

If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; FIO

One piece, 12 by 12 inches, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds; FIO

Two samples of each type to be used and descriptive data.

Sealant; FIO

One sample, approximately 1 pound, and descriptive data.

Concealed Anchor Clips; FIO

Two samples of each type used.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by ordinary exposure to the elements and service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the following: panel seams and joint, all accessories, components and trim; penetrations such as vents, curbs, and skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed to provide a weathertight roof system; and items specified in other sections of these specifications that become part of the structural standing seam metal roof system. All material and workmanship deficiencies, system deterioration caused by ordinary exposure to the elements and service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor may supplement this warranty with written warranties from the installer and/or manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached example WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility or the date the Government takes possession, whichever is earlier. It shall be understood that the Contractor's Performance Bond will remain effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

- a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture,

structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

- b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. When length of run exceeds 30 feet and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 100 feet may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 24 inches of coverage in place. SSSMR system with roofing panels greater than 12 inches in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 1.5 inches for rolled seam and 1 inches for seams that are not rolled.

2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653; aluminum-zinc alloy coated steel conforming to ASTM A 792, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 E5. Uncoated panels shall be 0.0239 inch thick minimum. Panels shall be within 95 percent of tested thickness.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 750 pounds per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 3/8 inch for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 1/4 inch diameter, shouldered or plain shank as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 1/4 inch diameter. Blind (pop) rivets shall be not less than 9/32 inch minimum diameter.

2.5 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall be selected by the Contracting Officer and shall not be limited to the manufacturer's standard colors. The exterior coating shall be a nominal 2 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 1.0 mil thickness. The interior color finish shall consist of a nominal 1 mil thick finish otherwise the same as the exterior. The exterior color finish shall meet the test requirements specified below.

2.5.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of 10, no blistering, as determined by ASTM D 714; and a rating of 8, 1/32 inch failure at scribe, as determined by ASTM D 1654.

2.5.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.5.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.5.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.5.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no loss of adhesion.

2.5.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 80 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.5.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.6 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation, including facings, shall have a flame spread not in excess of 75 and a smoke developed rating not in excess of 150 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests

are conducted in the insulation manufacturer's laboratory.

2.6.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, Class 1 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For polyisocyanurate the maximum design R-value per 1 inch of insulation used shall be 7.2. Facings shall be non-asphaltic, glass fiber reinforced.

2.6.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

2.7 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

2.8 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.9 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.10 VAPOR RETARDER

2.10.1 Vapor Retarders as Integral Facing

Insulation facing shall have a permeability of 0.1 perm or less when tested in accordance with ASTM E 96. Facing shall be white. Facings and finishes shall be factory applied.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as

recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Field Forming of Panels

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.2 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

3.1.3 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. Attachment to the substrate (when provided) or to the panels is not permitted. The maximum distance, parallel to the seams, between clips shall be 30 inches on center at the corner, edge, and ridge zones, and 5 feet maximum on centers for the remainder of the roof.

3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 4 fasteners per square feet. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the

underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.

3.2.2 Blanket Insulation

Blanket insulation shall be installed between and parallel to the purlins with tabs of a facer lapping on the top face of the purlins. Thermal blocks shall be provided over purlins, between clips. A second layer of unfaced insulation shall be added between purlins to provide full R-value. Blanket insulation shall be supported by an integral facing or other commercially available support system.

3.3 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PROJECT DESCRIPTION AND LOCATION (Include Bldg. No.): _____
CORPS OF ENGINEERS CONTRACT NUMBER: _____
SPECIFICATION SECTION NUMBER & DESCRIPTION:

07416 STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

CONTRACTOR: _____
ADDRESS: _____
POINT OF CONTACT: _____
TELEPHONE NUMBER: _____

OWNER: _____
ADDRESS: _____
POINT OF CONTACT: _____
TELEPHONE NUMBER: _____

CONSTRUCTION AGENT: _____
ADDRESS: _____
POINT OF CONTACT: _____
TELEPHONE NUMBER: _____

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE THE ENTIRE ROOFING SYSTEM, INCLUDING THE STANDING SEAM METAL ROOF PANELS, PANEL FINISHES, ROOFING SECUREMENT COMPONENTS, ALL ACCESSORIES, COMPONENTS, AND TRIM; INCLUDING PENETRATIONS SUCH VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM. ALL LEAKS SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President) (Date)

(SEE REVERSE SIDE FOR SUPPLEMENTAL PROVISIONS AND EXCLUSIONS)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE CONTRACTOR MAY SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE INSTALLER AND/OR MANUFACTURER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THE WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE FROM THE ROOF AND ALLOW PONDING WATER. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES, UNLESS OTHERWISE APPROVED IN WRITING BY THE CONTRACTING OFFICER.

LEAKS SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07600

SHEET METALWORK, GENERAL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Coordination
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Accessories
 - 2.1.2 Aluminum Extrusions
 - 2.1.3 Bituminous Cement
 - 2.1.4 Sealant
 - 2.1.5 Fasteners
 - 2.1.6 Felt
 - 2.1.7 Polyvinyl Chloride (PVC) Reglets
 - 2.1.8 Stainless Steel
 - 2.1.9 Solder
 - 2.1.10 Through-Wall Flashing
 - 2.1.11 Louver Screen

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 EXPANSION JOINTS
- 3.3 PROTECTION OF ALUMINUM
 - 3.3.1 Paint
 - 3.3.2 Nonabsorptive Tape or Gasket
- 3.4 CONNECTIONS AND JOINTING
 - 3.4.1 Soldering
 - 3.4.2 Riveting
 - 3.4.3 Seaming
- 3.5 CLEATS
- 3.6 GUTTERS AND DOWNSPOUTS
- 3.7 FLASHINGS
 - 3.7.1 Base Flashing
 - 3.7.2 Counter Flashings
 - 3.7.3 Stepped Flashing
 - 3.7.4 Through-Wall Flashing
 - 3.7.4.1 Lintel Flashing
 - 3.7.4.2 Sill Flashing
 - 3.7.5 Valley Flashing
- 3.8 GRAVEL STOPS AND FASCIA
- 3.9 INSTALLATION OF LOUVERS

- 3.10 REGLETS
- 3.11 CONTRACTOR QUALITY CONTROL

-- End of Section Table of Contents --

SECTION 07600

SHEET METALWORK, GENERAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM A 167 | (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| ASTM B 32 | (1995b) Solder Metal |
| ASTM B 221 | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes |
| ASTM D 226 | (1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |
| ASTM D 543 | (1987) Resistance of Plastics to Chemical Reagents |
| ASTM D 822 | (1995) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus |
| ASTM D 828 | (1993) Tensile Breaking Strength of Paper and Paperboard |
| ASTM D 1784 | (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds |
| ASTM D 2822 | (1991) Asphalt Roof Cement |
| ASTM D 4022 | (1994) Coal Tar Roof Cement, Asbestos Containing |
| ASTM D 4586 | (1993) Asphalt Roof Cement, Asbestos Free |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

| | |
|--------------|----------------------------------|
| ISWA IWS 089 | (1990) Recommended Standards and |
|--------------|----------------------------------|

Specifications for Insect Wire Screening
(Wire Fabric)

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
(SMACNA)

SMACNA-02

(1993) Architectural Sheet Metal Manual

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction.

1.2.1 Coordination

Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Materials; GA

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA-02 for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA-02. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586. For coal tar roofing; coal tar cement conforming to ASTM D 4022.

2.1.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900 JOINT SEALING.

2.1.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.1.6 Felt

ASTM D 226, Type I.

2.1.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784, Class 14333D, 0.075 inch minimum thickness.

2.1.1.8 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.1.9 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.1.10 Through-Wall Flashing

- a. Nonreinforced, waterproof, impermeable extruded elastomeric single ply sheeting not less than 30 mils thick.
- b. Other through-wall flashing material may be used provided the following performance criteria are met.

(1) No cracking or flaking when bent 180 degrees over a 1/32 inch mandrel and rebent at the same point over the same mandrel in an opposite direction at 32 degrees F.

(2) Water vapor permeability not more than 2 perms when tested in accordance with ASTM E 96.

(3) Minimum breaking strength of 90 pounds per inch width in the weakest direction when tested in accordance with ASTM D 828.

(4) No visible deterioration after being subjected to a 400-hour direct weathering test in accordance with ASTM D 822.

(5) No shrinkage in length or width and less than 5 percent loss of breaking strength after a 10-day immersion, per ASTM D 543, in 5 percent (by weight) solutions, respectively, of sulfuric acid, hydrochloric acid, sodium hydroxide or saturated lime (calcium hydroxide).

2.1.11 Louver Screen

Type III aluminum alloy insect screening conforming to ISWA IWS 089.

PART 3 EXECUTION

3.1 GENERAL

Items such as gutters, downspouts and louvers shall be fabricated in conformance with SMACNA-02 and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inch hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided as specified in SMACNA-02. Expansion joints in continuous sheet metal shall be provided at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, except extruded aluminum gravel stops and fasciae which shall have expansion joints at not more than 12 foot spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

3.4 CONNECTIONS AND JOINTING

3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be

done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

3.4.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 1/8 inch apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

3.6 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be installed as indicated. Gutters shall be supported as indicated or by cleats spaced not less than 36 inches apart. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations.

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than 3 inches on centers. Metal base flashing shall not be used on built-up roofing.

3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown in SMACNA-02.

Where bituminous base flashings are provided, the counter flashing shall extend down as close as practicable to the top of the cant strip. Counter flashing shall be factory formed to provide spring action against the base flashing.

3.7.3 Stepped Flashing

Stepped flashing shall be installed where sloping roofs surfaced with shingles abut vertical surfaces. Separate pieces of base flashing shall be placed in alternate shingle courses.

3.7.4 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

3.7.4.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 2 inches, or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.7.4.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.7.5 Valley Flashing

Valley flashing shall be installed as specified in SMACNA-02 and as indicated.

3.8 GRAVEL STOPS AND FASCIA

Gravel stops and fascia shall be fabricated and installed as indicated and in accordance with SMACNA-02.

3.9 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

3.10 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of

the slot during installation. Reglet plugs shall be spaced not over 12 inches on centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 12 inches to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be sealed with the manufacturer's recommended sealant.

3.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07900

JOINT SEALING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 ENVIRONMENTAL REQUIREMENTS
- 1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 BACKING
 - 2.1.1 Rubber
- 2.2 BOND-BREAKER
- 2.3 PRIMER
- 2.4 SEALANT
 - 2.4.1 LATEX (Provide at all interior non-working applications.)
 - 2.4.2 ELASTOMERIC (Provide at all exterior applications and interior working applications.)
- 2.5 SOLVENTS AND CLEANING AGENTS

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Surface Preparation
 - 3.1.2 Concrete and Masonry Surfaces
 - 3.1.3 Steel Surfaces
 - 3.1.4 Aluminum Surfaces
 - 3.1.5 Wood Surfaces
- 3.2 APPLICATION
 - 3.2.1 Masking Tape
 - 3.2.2 Backing
 - 3.2.3 Bond-Breaker
 - 3.2.4 Primer
 - 3.2.5 Sealant
- 3.3 CLEANING

-- End of Section Table of Contents --

SECTION 07900

JOINT SEALING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM C 834 | (1995) Latex Sealants |
| ASTM C 920 | (1994) Elastomeric Joint Sealants |
| ASTM D 1056 | (1991) Flexible Cellular Materials - Sponge or Expanded Rubber |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Backing; GA Bond-Breaker; GA

Sealant; GA

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-13 Certificates

Sealant; GA

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall

include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A, round cross section.

2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.4 SEALANT

2.4.1 LATEX (Provide at all interior non-working applications.)

Latex Sealant shall be ASTM C 834.

2.4.2 ELASTOMERIC (Provide at all exterior applications and interior working applications.)

Elastomeric sealants shall conform to ASTM C 920 and the following:

- b. Polyurethane sealant: Grade NS, Class 25, Use NT, M, G, A, O.

2.5 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped

dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape may be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE
- 1.4 WARRANTY

PART 2 PRODUCTS

- 2.1 DOORS AND FRAMES
- 2.2 FIRE RATED DOORS
- 2.3 THERMAL INSULATED DOORS
- 2.4 WEATHERSTRIPPING
- 2.5 TRANSOM AND SIDELIGHT PANELS
- 2.6 LOUVERS
- 2.7 GLAZING
- 2.8 FACTORY FINISH

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Thermal Insulated Doors
 - 3.1.2 Security Doors
- 3.2 FIELD PAINTED FINISH

-- End of Section Table of Contents --

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM C 236 | (1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box |
| ASTM C 976 | (1990) Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box |
| ASTM D 2863 | (1991) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index) |
| ASTM E 283 | (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |

DOOR AND HARDWARE INSTITUTE (DHI)

| | |
|-------------|--|
| DHI A115.1G | (1994) Installation Guide for Doors and Hardware |
|-------------|--|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|---|
| NFPA 80 | X (1995) Fire Doors and Windows |
| NFPA 80A | (1993) Protection of Buildings from Exterior Fire Exposures |
| NFPA 101 | X (1997) Safety to Life from Fire in Buildings and Structures |
| NFPA 252 | (1995) Fire Tests of Door Assemblies |

STEEL DOOR INSTITUTE (SDOI)

| | |
|--------------|--|
| SDOI SDI-100 | (1991) Standard Steel Doors and Frames |
| SDOI SDI-106 | (1996) Standard Door Type Nomenclature |
| SDOI SDI-107 | (1984) Hardware on Steel Doors |

(Reinforcement - Application)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Steel Doors and Frames; GA

Drawings using standard door type nomenclature in accordance with SDOI SDI-106 indicating the location of each door and frame, elevation of each model of door and frame, details of construction, method of assembling sections, location and extent of hardware reinforcement, hardware locations, type and location of anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the doors, frames, and weatherstripping including air infiltration data and manufacturers printed instructions.

SD-09 Reports

Fire Rated Doors; GA

A letter by a nationally recognized testing laboratory which identifies the product manufacturer, type, and model; certifying that the laboratory has tested a sample assembly in accordance with NFPA 252 and issued a current listing for same.

SD-13 Certificates

Fire Rated Doors; GA Thermal Insulated Doors; GA

- a. Certification of Oversized Fire Doors: Certificates of compliance in accordance with the requirements of NFPA 252 for fire doors exceeding the sizes for which label service is available.
- b. Certification of Thermal Insulating Rating: Certification or test report for thermal insulated doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

1.3 DELIVERY AND STORAGE

During shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or shall be provided with temporary steel spreaders at the bottom of each frame; and knockdown type frames shall be securely strapped in bundles. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting air circulation. Doors and assembled frames shall be stored in an upright position in accordance with DHI A115.1G.

Abraded, scarred, or rusty areas shall be cleaned and touched up with matching finishes.

1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated in accordance with SDOI SDI-100 and the additional requirements specified herein. Door grade shall be extra heavy duty (Grade III) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be designation G60 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 18 gauge steel or 7 gauge diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Full glass doors shall conform to SDOI SDI-100, Model 3, and shall include provisions for glazing. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with SDOI SDI-100 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

2.2 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with NFPA 252 and having a listing for the tested assemblies. The fire resistance rating shall be as shown. Doors exceeding the sizes for which listing label service is offered shall be in accordance with NFPA 252. Listing identification labels shall be constructed and permanently applied by a method which results in their destruction should they be removed.

2.3 THERMAL INSULATED DOORS

The interior of thermal insulated doors shall be completely filled with rigid plastic foam permanently bonded to each face panel. The thermal conductance (U-value) through the door shall not exceed 0.41 btu/hr times sq f times f when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863.

2.4 WEATHERSTRIPPING

Unless otherwise specified in Section 08700 BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations.

Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed 0.20 cfm per linear foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.5 TRANSOM AND SIDELIGHT PANELS

Panels for transom and sidelight shall be constructed in accordance with SDOI SDI-100. Panels shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors.

2.6 LOUVERS

Where indicated, doors shall be provided with full louvers or louver sections. Louvers shall be sightproof type inserted into the door. Pierced louvers shall not be used on exterior doors. Inserted louvers shall be stationary. Louvers shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors. Insect screens shall be a removable type with 18 by 16 mesh aluminum or bronze cloth. Full louver doors shall be in accordance with SDOI SDI-100, Grade III, Model 3.

2.7 GLAZING

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

2.8 FACTORY FINISH

Doors and frames shall be phosphatized and primed with standard factory primer system.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with DHI A115.1G. Preparation for surface applied hardware shall be in accordance with SDOI SDI-107. Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied silencers are not acceptable. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Installation and operational characteristics of fire doors shall be in accordance with NFPA 80, NFPA 80A and NFPA 101. Hollow metal door frames shall be solid grouted in masonry walls.

3.1.1 Thermal Insulated Doors

Hardware and perimeter seals shall be adjusted for proper operation. Doors shall be sealed weathertight after installation of hardware and shall be in accordance with Section 07900 JOINT SEALING.

3.1.2 Security Doors

Door frames shall be rigidly anchored in place and provided with antispread space filler reinforcements to prevent disengagement of the lock bolt by prying or jacking of the frame. Jams shall be filled solid with concrete grout.

3.2 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section

09900 PAINTING, GENERAL. Weatherstrips shall be protected from paint.
Finish shall be free of scratches or other blemishes.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08210

WOOD DOORS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Standard Products
 - 1.2.2 Marking
- 1.3 SUBMITTALS
- 1.4 STORAGE
- 1.5 HARDWARE
- 1.6 GLAZING
- 1.7 WARRANTY

PART 2 PRODUCTS

- 2.1 GENERAL FABRICATION REQUIREMENTS
 - 2.1.1 Edge Sealing
 - 2.1.2 Preservative Treatment
 - 2.1.3 Adhesives
 - 2.1.4 Prefitting
- 2.2 FLUSH DOORS
 - 2.2.1 Core Construction
 - 2.2.1.1 Solid Cores
 - 2.2.1.2 Painted Wood Veneer Doors
- 2.3 FIRE RATED DOORS
 - 2.3.1 Reinforcement Blocking
 - 2.3.2 Stile Edges
- 2.4 MOULDING AND EDGING
- 2.5 INSERT LOUVERS

PART 3 EXECUTION

- 3.1 INSTALLATION OF DOORS
 - 3.1.1 General Use Doors
 - 3.1.2 Fire Doors
- 3.2 FIELD FINISHING

-- End of Section Table of Contents --

SECTION 08210

WOOD DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|---|
| NFPA 80 | (1995) Fire Doors and Windows |
| NFPA 101 | (1997) Safety to Life from Fire in Buildings and Structures |
| NFPA 252 | (1995) Fire Tests of Door Assemblies |

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

| | |
|----------------|---|
| NWWDA I.S. 1-A | (1993) Architectural Wood Flush Doors |
| NWWDA I.S. 4 | (1994) Water-Repellent Preservative Non-Pressure Treatment for Millwork |

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Wood Doors and Frames; GA

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, flashing, and thresholds to be used.

SD-13 Certificates

Fire Rated Doors; GA Adhesives; GA

Certificates for oversize fire doors and/or door/frame assemblies stating that the doors are identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated. Certificate stating that adhesives used for proposed doors do not contain any formaldehyde.

1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section 08700 BUILDERS' HARDWARE.

1.6 GLAZING

Glazing is specified in Section 08810 GLASS AND GLAZING

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Preservative Treatment

Exterior softwood doors shall be water-repellent preservative treated in accordance with NWWDA I.S. 4.

2.1.3 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type I Bond Doors (waterproof) for exterior doors and requirements for Type II Bond Doors (water-repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives shall contain no formaldehydes.

2.1.4 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor, except plastic laminate clad doors shall be furnished prefitted in accordance with the standards under which they are produced.

2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to NWWDA I.S. 1-A, except for the one year acclimatization requirement in paragraph T-2, which shall not apply. Wood doors shall be 5-ply or 7-ply construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Door construction shall be particle board core with vertical and horizontal edges bonded to the core.

2.2.1.2 Painted Wood Veneer Doors

Veneer doors to receive paint finish shall be Economy Grade in accordance with NWWDA I.S. 1-A. Door finish shall be in accordance with paragraph FIELD FINISHING.

2.3 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with NFPA 252 and having a listing for the tested assemblies. The specific time interval rating on the labels shall be as shown. Door assemblies shall be in accordance with NFPA 80. Listing identification on labels shall be constructed and permanently applied by a method which results in their destruction should they be removed.

2.3.1 Reinforcement Blocking

Fire rated doors shall be provided, as required, with hardware reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be manufacturer's standard. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

2.3.2 Stile Edges

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts. Vertical stiles shall be of the same species and/or color as the face veneer.

2.4 MOULDING AND EDGING

Moulding and edging shall be as shown. Wood species for transparent finished doors shall be compatible with veneer.

2.5 INSERT LOUVERS

Where indicated, doors shall be provided with sightproof insert louvers. Louvers shall be stationary or adjustable as shown. Blades shall be welded

or tenoned to the frame and the entire assembly fastened to the door with metal or wood moldings on both sides as shown. The frame shall be nonremovable from the outside of the door.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 1/8 inch at the sides and top and shall have a bottom clearance of 1/4 inch over thresholds and 1/2 inch at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 1/8 inch in 2 inches. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

3.1.2 Fire Doors

Installation, hardware, and operational characteristics shall conform to NFPA 80 and NFPA 101 and shall be in strict conformance with the manufacturer's printed instructions. Properly sized pilot holes shall be drilled for screws in door edges. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lockstile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer.

3.2 FIELD FINISHING

Doors to receive field finishing, whether paint or natural finish, shall be factory primed or sealed, as required, and then shall be finished in accordance with Section 09900 PAINTING, GENERAL. Factory applied sealer shall not prevent doors from accepting field finish.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08510

STEEL WINDOWS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 WINDOW PERFORMANCE
 - 1.2.1 Structural Performance
 - 1.2.2 Air Infiltration
 - 1.2.3 Water Penetration
 - 1.2.4 Thermal Performance
 - 1.2.5 Life Safety Criteria
- 1.3 SUBMITTALS
- 1.4 QUALIFICATION
- 1.5 MOCK-UPS
- 1.6 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Steel Bars
 - 2.1.2 Sheet Steel
 - 2.1.3 Screws and Bolts
- 2.2 STEEL WINDOW TYPES
 - 2.2.1 Fixed Windows
 - 2.2.2 Fire-Rated Windows
- 2.3 WEATHERSTRIPPING
- 2.4 ACCESSORIES
 - 2.4.1 Fasteners
- 2.5 FINISHES
 - 2.5.1 Prime Coat

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 ADJUSTMENTS AND CLEANING
 - 3.2.1 Hardware Adjustments
 - 3.2.2 Cleaning
- 3.3 FIELD PAINTED FINISH

-- End of Section Table of Contents --

SECTION 08510

STEEL WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|------------|--|
| ASTM A 569 | (1991a; R 1993) Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality |
| ASTM A 653 | (1994) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A 924 | (1994) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process |
| ASTM B 766 | (1986; R 1993) Electrodeposited Coatings of Cadmium |
| ASTM C 236 | (1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box |
| ASTM E 283 | (1991) Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
| ASTM E 330 | (1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference |
| ASTM E 331 | (1993) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|--------------|---|
| ASME B18.6.3 | (1972; R 1991) Machine Screws and Machine Screw Nuts |
| ASME B18.6.4 | (1981; R 1991) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws (Inch Series) |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|---|
| NFPA 80 | (1992) Fire Doors and Windows |
| NFPA 101 | (1994) Safety to Life from Fire in Buildings and Structures |

STEEL WINDOW INSTITUTE (SWI)

| | |
|--------|---|
| SWI-01 | (1989) The Specifier's Guide to Steel Windows |
|--------|---|

1.2 WINDOW PERFORMANCE

Steel windows shall be designed to meet the following performance requirements, and shall be of the type and size indicated. Fire-rated windows shall bear the Underwriters Laboratories, Warnock Hersey, Factory Mutual or other nationally recognized testing laboratory label for the indicated rating.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by SWI-01 for the window types specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by SWI-01 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by SWI-01 for each window type when tested in accordance with ASTM E 331.

1.2.4 Thermal Performance

Thermal resistance shall meet requirements established by ASTM C 236.

1.2.5 Life Safety Criteria

Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Steel Windows; GA

Manufacturer's descriptive data and catalog cut sheets.

SD-04 Drawings

Steel Windows; GA Insect Screens; GA

Drawings indicating elevations of windows, rough-opening dimensions for each type and size of windows, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, screen details including method of attachment, and window schedules showing locations of each window type and indicating compliance with fire safety code, where required.

SD-13 Certificates

Steel Windows; GA

Certificates stating that the steel windows conform to requirements of this section.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of steel windows specified, and shall have a minimum of five (5) years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 MOCK-UPS

Before fabrication, full-size mock-up of one window unit complete with glass and manufacturer's certification shall be required for the review of window construction and quality of hardware operation. The approval of mock-up will establish the minimum standard of quality required for steel windows.

1.6 DELIVERY AND STORAGE

Steel windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Bars

Steel bars shall be solid one-piece sections hot-rolled from new billet steel in accordance with SWI-01.

2.1.2 Sheet Steel

Hot-rolled sheet steel shall conform to ASTM A 569, commercial quality with a minimum of 0.15 percent carbon. Sheet steel shall be zinc coated

(galvanized) by the hot-dip process in accordance with ASTM A 653 or ASTM A 924.

2.1.3 Screws and Bolts

Screws and bolts shall conform to ASTM B 766, ASME B18.6.3 and ASME B18.6.4.

2.2 STEEL WINDOW TYPES

Steel windows shall be designed for outside field glazing, and for glass types scheduled on drawings and specified in Section \08810=\ GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet requirements of paragraph WINDOW PERFORMANCE and SWI-01. Glazing material shall be compatible with steel, and shall not require painting.

2.2.1 Fixed Windows

Steel fixed windows shall conform to SWI-01 Heavy Custom type.

2.2.2 Fire-Rated Windows

Fire-rated windows shall conform to SWI-01 and shall be labeled with a 3/4-hour fire-test rating. Units shall be designed and fabricated from one-piece hot-rolled steel members to meet glass sizes, window sizes and opening dimensions established by NFPA 80. Hardware shall conform to NFPA 80 requirements.

2.3 WEATHERSTRIPPING

Weatherstripping shall be designed to meet water penetration and air infiltration requirements specified under paragraph WINDOW PERFORMANCE in accordance with SWI-01, and shall be manufactured of material compatible with steel and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from non-magnetic stainless steel, cadmium-plated steel, zinc-plated steel, nickel/chrome-plated steel or magnetic stainless steel in compliance with SWI-01. Self-tapping sheet metal screws are not acceptable for material thicker than 1/16 inch.

2.5 FINISHES

2.5.1 Prime Coat

Steel windows, fins, mullions, cover plates and associated parts shall be cleaned, treated and factory primed with manufacturer's standard primer coat in a dry film thickness of not less than 1.0 mil. Primer coat shall be free of scratches and other blemishes. Paint finish shall be in accordance with paragraph FIELD PAINTED FINISH.

PART 3 EXECUTION

3.1 INSTALLATION

Steel windows shall be installed in accordance with approved shop drawings and manufacturer's approved recommendations. Fire-rated windows shall be installed in compliance with NFPA 80 and NFPA 101. Steel surfaces in close proximity with masonry, concrete, wood, and dissimilar metals other than stainless steel, zinc, cadmium, or small areas of white bronze shall be protected from direct contact. The completed window installation shall be watertight and shall be in accordance with Section 07900, JOINT SEALING. Glazing shall be installed in accordance with requirements of this section and Section 08810, GLASS AND GLAZING. Fire-rated windows shall be glazed in accordance with NFPA 80.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete.

3.2.2 Cleaning

Steel window finish and glass shall be cleaned on interior and exterior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used.

3.3 FIELD PAINTED FINISH

Steel windows shall be field painted in accordance with Section 09900, PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches and other blemishes.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 WINDOW PERFORMANCE
 - 1.2.1 Structural Performance
 - 1.2.2 Air Infiltration
 - 1.2.3 Water Penetration
 - 1.2.4 Thermal Performance
 - 1.2.5 Life Safety Criteria
- 1.3 SUBMITTALS
- 1.4 QUALIFICATION
- 1.5 MOCK-UPS
- 1.6 DELIVERY AND STORAGE
- 1.7 WARRANTY

PART 2 PRODUCTS

- 2.1 ALUMINUM WINDOW TYPES
 - 2.1.1 Awning Windows
 - 2.1.2 Single-Hung and Double-Hung Windows
 - 2.1.3 Horizontal-Sliding Windows
 - 2.1.4 Projected Windows
- 2.2 WEATHERSTRIPPING
- 2.3 INSECT SCREENS
- 2.4 ACCESSORIES
 - 2.4.1 Fasteners
 - 2.4.2 Hardware
 - 2.4.3 Window Guards, Bar-Grille Type
- 2.5 GLASS AND GLAZING
- 2.6 FINISH
 - 2.6.1 Baked-Acrylic Resin-Based Coating
 - 2.6.2 Color

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 ADJUSTMENTS AND CLEANING
 - 3.2.1 Hardware Adjustments
 - 3.2.2 Cleaning

-- End of Section Table of Contents --

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- | | |
|-------------|---|
| AAMA 101 | (1993) Voluntary Specifications for Aluminum and Poly(Vinyl Chloride) (PVC) Prime Windows and Glass Doors |
| AAMA 603.8 | (1992) Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum |
| AAMA 1503.1 | (1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|--|
| ASTM E 283 | (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen |
| ASTM E 330 | (1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference |
| ASTM E 547 | (1993) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential |

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

- | | |
|--------------|---|
| ISWA IWS 089 | (1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric) |
|--------------|---|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- | | |
|----------|---|
| NFPA 101 | (1994) Safety to Life from Fire in Buildings and Structures |
|----------|---|

SCREEN MANUFACTURERS ASSOCIATION (SMA)

- | | |
|----------|---|
| SMA 1004 | (1987) Aluminum Tubular Frame Screens for |
|----------|---|

Windows

1.2 WINDOW PERFORMANCE

Aluminum windows shall be designed to meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 547.

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed R-Value Class R3.33 when tested in accordance with AAMA 1503.1.

1.2.5 Life Safety Criteria

Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Aluminum Windows; GA

Manufacturer's descriptive data and catalog cut sheets.

SD-04 Drawings

Aluminum Windows; GA Insect Screens; GA

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal,

fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, screen details including method of attachment, and window schedules showing locations of each window type.

SD-06 Instructions

Aluminum Windows; GA

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-09 Reports

Aluminum Windows; FIO

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

SD-13 Certificates

Aluminum Windows; FIO

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates.

SD-14 Samples

Aluminum Windows; GA

Manufacturer's standard color samples of the specified finishes.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of five (5) years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 MOCK-UPS

Before fabrication, full-size mock-up of each type of aluminum window complete with glass and AAMA certification label shall be required for review of window construction and quality of hardware operation.

1.6 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101. Windows shall be double-glazed.

2.1.1 Awning Windows

Aluminum awning windows shall conform to AAMA 101 Designation A-C20 type consisting of top-hinged ventilators arranged in a vertical series within a common frame. Windows shall be operated by one device which shall securely close the ventilators at both jambs without the use of additional manually-controlled locking device. Operating hardware except ventilator arms and rotary operators, shall be concealed within frame and sill. Ventilator arms shall be concealed when windows are closed.

2.1.2 Single-Hung and Double-Hung Windows

Aluminum single-hung and double-hung windows shall conform to AAMA 101 DH-C50 type which operate vertically with the weight of sash offset by a counterbalancing mechanism mounted in window to hold the sash stationary at any open position. Windows shall be provided with a tilt-in sash. Single-hung and double-hung windows shall be provided with devices to secure the sash in the closed position. Counterbalancing mechanisms shall be easily replaced after installation.

2.1.3 Horizontal-Sliding Windows

Aluminum horizontal windows shall conform to AAMA 101 HS-HC40 type consisting of sliding sash and fixed lite. Sash guides shall be nylon wheels.

2.1.4 Projected Windows

Aluminum projected windows shall conform to AAMA 101 Designation P-C50 type. Window ventilators shall be equipped with concealed four-bar friction hinges.

2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.3 INSECT SCREENS

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings. Insect screens shall be fabricated of roll-formed tubular-shaped aluminum frames conforming to SMA 1004 and (18 x 16) aluminum mesh screening conforming with ISWA IWS 089, Type III.

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel or magnetic stainless steel in compliance with AAMA 101.

Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel of quality established by AAMA 101.

2.4.3 Window Guards, Bar-Grille Type

See Section 05500 MISCELLANEOUS METAL for window guards, bar-grille type.

2.5 GLASS AND GLAZING

Aluminum windows shall be designed for factory inside glazing, and for glass types scheduled on drawings and specified in Section 08810 GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

2.6 FINISH

2.6.1 Baked-Acrylic Resin-Based Coating

Exposed surfaces of aluminum windows shall be finished with acrylic resin-based coating conforming to AAMA 603.8, total dry thickness of 1.0 dry mils. Finish shall be free of scratches and other blemishes.

2.6.2 Color

Color shall be as selected by Contracting Officer from manufacturer's standard colors. There shall be a minimum of eight (8) standard colors provided for selection purposes.

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07900 JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810 GLASS AND GLAZING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08700

BUILDERS' HARDWARE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 PREDELIVERY CONFERENCE
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 SPECIAL TOOLS
- 1.6 WARRANTY
- 1.7 OPERATION AND MAINTENANCE MANUALS

PART 2 PRODUCTS

- 2.1 GENERAL HARDWARE REQUIREMENTS
- 2.2 TEMPLATES
- 2.3 HINGES
 - 2.3.1 Hinges for Reverse Bevel Doors with Locks
 - 2.3.2 Contractor's Option
 - 2.3.3 Spring Hinges
- 2.4 LOCKS AND LATCHES
 - 2.4.1 Mortise Lock and Latchsets
 - 2.4.2 Bored Lock and Latchsets
 - 2.4.3 Lock Cylinders (Mortise, Rim and Bored)
 - 2.4.4 Padlocks
 - 2.4.5 Lock Trim
- 2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES
 - 2.5.1 Exit Devices and Auxiliary Items
 - 2.5.2 Door Coordinator
 - 2.5.3 Removable Mullions
- 2.6 KEYING
- 2.7 DOOR CLOSING DEVICES
 - 2.7.1 Surface Type Closers
- 2.8 DOOR CONTROLS - OVERHEAD HOLDERS
- 2.9 ARCHITECTURAL DOOR TRIM
 - 2.9.1 Door Protection Plates
 - 2.9.1.1 Kick Plates
 - 2.9.2 Push Plates
 - 2.9.2.1 Combination Push-Pull Plates
 - 2.9.2.2 Flat Plates
 - 2.9.3 Door Pulls and Push/Pull Units
- 2.10 AUXILIARY HARDWARE
- 2.11 MISCELLANEOUS
 - 2.11.1 Metal Thresholds
 - 2.11.2 Rain Drips
 - 2.11.3 Aluminum Housed Type Weatherseals
- 2.12 FASTENINGS
- 2.13 FINISHES

2.14 HARDWARE FOR FIRE DOORS

PART 3 EXECUTION

3.1 APPLICATION

3.1.1 Hardware for Fire Doors

3.1.2 Door-Closing Devices

3.1.3 Kick Plates

3.1.4 Auxiliary Hardware

3.1.5 Thresholds

3.1.6 Rain Drips

3.1.7 Weatherseals

3.1.8 Gasketing

3.2 OPERATIONAL TESTS

3.3 HARDWARE SETS

-- End of Section Table of Contents --

SECTION 08700

BUILDERS' HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|---|
| ASTM E 283 | (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen |
| ASTM F 883 | (1990) Padlocks |

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

- | | |
|------------------------|--|
| BHMA-01 | (Effective thru Jun 1995) Directory of Certified Locks & Latches |
| BHMA-02 | (Effective thru Jul 1995) Directory of Certified Door Closers |
| BHMA-03 | (Effective thru Jul 1996) Directory of Certified Exit Devices |
| BHMA ANSI/BHMA A156.1 | (1988) Butts and Hinges |
| BHMA ANSI/BHMA A156.2 | (1989) Bored and Preassembled Locks and Latches |
| BHMA ANSI/BHMA A156.3 | (1994) Exit Devices |
| BHMA ANSI/BHMA A156.4 | (1992) Door Controls - Closers |
| BHMA ANSI/BHMA A156.5 | (1992) Auxiliary Locks & Associated Products |
| BHMA ANSI/BHMA A156.6 | (1994) Architectural Door Trim |
| BHMA ANSI/BHMA A156.7 | (1988) Template Hinge Dimensions |
| BHMA ANSI/BHMA A156.8 | (1994) Door Controls - Overhead Stops and Holders |
| BHMA ANSI/BHMA A156.13 | (1994) Mortise Locks & Latches |
| BHMA ANSI/BHMA A156.16 | (1989) Auxiliary Hardware |

| | |
|------------------------|---------------------------------------|
| BHMA ANSI/BHMA A156.17 | (1993) Self Closing Hinges & Pivots |
| BHMA ANSI/BHMA A156.18 | (1993) Materials and Finishes |
| BHMA ANSI/BHMA A156.20 | (1989) Strap and Tee Hinges and Hasps |
| BHMA ANSI/BHMA A156.21 | (1989) Thresholds |

DOOR AND HARDWARE INSTITUTE (DHI)

| | |
|-------------|---|
| DHI-03 | (1989) Keying Systems and Nomenclature |
| DHI-04 | (1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames |
| DHI-05 | (1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames |
| DHI-A115.IG | (1994) Installation Guide for Doors and Hardware |
| DHI A115-W | (Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9) |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|---|
| NFPA 80 | (1995) Fire Doors and Windows |
| NFPA 101 | (1997) Safety to Life from Fire in Buildings and Structures |

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Hardware and Accessories; GA

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 3 month(s) prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Hardware Devices; GA.

Detail drawings for hardware devices for computerized keying systems, magnetic cards, keyless push button access control systems, and other electrical hardware devices showing complete wiring and schematic diagrams and other details required to demonstrate proper function of units.

SD-07 Schedules

Hardware Schedule; GA

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; the ANSI number specified, sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

Keying Schedule; GA.

Keying schedule developed in accordance with DHI-03, after the keying meeting with the user.

SD-13 Certificates

Hardware and Accessories; GA

The hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of the product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in BHMA-01, BHMA-02 and BHMA-03 directories of certified products may be submitted in lieu of certificates.

1.3 PREDELIVERY CONFERENCE

Upon approval of the Hardware Schedule, the construction Contractor shall arrange a conference with the hardware supplier, Contracting Officer and the using agency to determine keying system requirements. Location of the key control storage system, set-up and key identification labeling will also be determined.

1.4 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

1.5 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend

beyond a one year period shall be provided.

1.7 OPERATION AND MAINTENANCE MANUALS

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides shall be provided. The instructions for electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices shall include simplified diagrams as installed.

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings.

2.2 TEMPLATES

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA ANSI/BHMA A156.7.

2.3 HINGES

Hinges shall conform to BHMA ANSI/BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA ANSI/BHMA A156.7. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

2.3.3 Spring Hinges

Spring hinges shall conform to BHMA ANSI/BHMA A156.17.

2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished with wrought boxes.

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform

to BHMA ANSI/BHMA A156.13, operational Grade 1. Mortise type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

2.4.2 Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA ANSI/BHMA A156.2, Grade 1. Bored type locks and latches for doors 1-3/8 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door.

2.4.3 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA ANSI/BHMA A156.5. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. An extension of the existing keying system shall be provided. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset. All locksets, lockable exit devices, and padlocks shall accept same interchangeable cores.

2.4.4 Padlocks

Padlocks shall conform to ASTM F 883. Straps, tee hinges, and hasps shall conform to BHMA ANSI/BHMA A156.20.

2.4.5 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA ANSI/BHMA A156.2 or BHMA ANSI/BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inch thick. Knob diameter shall be 2-1/8 to 2-1/4 inches. Lever handles shall be of plain design with ends returned to no more than 1/2 inch from the door face.

2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

Exit devices and exit device accessories shall conform to BHMA ANSI/BHMA A156.3, Grade 1.

2.5.1 Exit Devices and Auxiliary Items

Trim shall be of wrought construction and commercial plain design with straight, beveled, or smoothly rounded sides, corners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strikes shall be provided for pairs of doors with mortise and vertical rod devices; except open back strikes shall be used on labeled doors only where specifically provided for in the published listings. Touch bars shall be provided in lieu of conventional crossbars and arms. Escutcheons shall be provided not less than 7 by 2-1/4 inches. Escutcheons shall be cut to suit cylinders and operating trim.

2.5.2 Door Coordinator

Door coordinator with carry bar shall be Type 21 and shall be provided for each pair of doors equipped with an overlapping astragal. The coordinator

may be gravity operated and shall be capable of holding the active door of a pair open until the inactive door has preceded it in the closing cycle. When used as fire exit hardware, the coordinator and carry bar shall be listed or labeled by a nationally recognized independent testing laboratory.

2.5.3 Removable Mullions

Removable mullions shall be Type 22 of the box type and shall be used only with those exit devices for which the mullions were manufactured. Mullions shall be furnished with mullion stabilizers of the same manufacturer.

2.6 KEYING

Locks shall be keyed in sets or subsets as scheduled. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

| | |
|--------------------|--------------------------|
| Locks: | 3 change keys each lock. |
| Master keyed sets: | 5 keys each set. |
| Grand master keys: | 5 total. |
| Control keys: | 5 total. |
| Construction keys: | 5 total. |
| Blank keys: | 20 total. |

The keys shall be furnished to the Contracting Officer arranged in a container in sets or subsets as scheduled.

2.7 DOOR CLOSING DEVICES

Door closing devices shall conform to BHMA ANSI/BHMA A156.4, Grade 1. Closing devices shall be products of one manufacturer for each type specified. The opening resistance of closing devices shall not exceed 15 lbf applied at the latch stile or exceed 5 lbf where low opening resistance is scheduled.

2.7.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C02000 Full Cover with options PT-4H, Size 1 or 2 through Size 6, and PT-4D with back check position valve. Closers for screen and storm doors shall be Type C09353. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall have parallel arms or shall be top jamb mounted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

2.8 DOOR CONTROLS - OVERHEAD HOLDERS

Door controls - overhead holders shall conform to BHMA ANSI/BHMA A156.8.

2.9 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA ANSI/BHMA A156.6.

2.9.1 Door Protection Plates

2.9.1.1 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 2

inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 12 inches, except where the bottom rail is less than 12 inches the plate shall extend to within 1/2 inch of the panel mold or glass bead. Edges of metal plates shall be square.

2.9.2 Push Plates

2.9.2.1 Combination Push-Pull Plates

Combination push-pull plates shall be Type J303, 0.050 inch thick minimum stainless steel beveled four edges.

2.9.2.2 Flat Plates

Flat plates shall be Type J301 0.50 inch thick stainless steel. Edges of metal plates shall be square.

2.9.3 Door Pulls and Push/Pull Units

2.10 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door holders, door stops, and roller latches, shall conform to BHMA ANSI/BHMA A156.16. Lever extension flush bolts shall be Type L14081.

2.11 MISCELLANEOUS

2.11.1 Metal Thresholds

Thresholds shall conform to BHMA ANSI/BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Where required, thresholds shall be modified to receive projecting bolts of flush bolts. Thresholds for doors accessible to the handicapped shall be beveled with slopes not exceeding 1:2 and with heights not exceeding 1/2 inch..

2.11.2 Rain Drips

Extruded aluminum, not less than 0.07 inch thick, mill finished. Door sill rain drips shall be 1-1/2 inches to 1-3/4 inches high by 5/8 inch projection. Overhead rain drips shall be approximately 1-1/2 inches high by 2-1/2 inches projection and shall extend 2 inches on either side of the door opening width.

2.11.3 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.12 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied

with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or other approved tamperproof type.

2.13 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA ANSI/BHMA A156.18. Where painting of primed surfaces is required, painting is specified in Section 09900 PAINTING, GENERAL.

2.14 HARDWARE FOR FIRE DOORS

Hardware for fire doors shall conform to the requirements of NFPA 80 and NFPA 101.

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05, except that deadlocks shall be mounted 48 inches above finish floor. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-A115.IG or DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

3.1.1 Hardware for Fire Doors

Hardware for fire doors shall be installed in accordance with the requirements of NFPA 80. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors.

3.1.2 Door-Closing Devices

Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors shall have the closer mounted on the room side of the door.

3.1.3 Kick Plates

Kick plates shall be installed on the push side of single-acting doors and on both sides of double-acting doors.

3.1.4 Auxiliary Hardware

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

3.1.5 Thresholds

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 12 inches. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 3/4 inch thread engagement into the floor or anchoring device used.

3.1.6 Rain Drips

Door sill rain drips shall align with the bottom edge of the door. Overhead rain drips shall align with bottom edge of door frame rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

3.1.7 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

3.1.8 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 1/8 inch clearance between door and frame. Frames shall be treated with tape primer prior to installation.

3.2 OPERATIONAL TESTS

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

3.3 HARDWARE SETS

CONTROL BUILDINGSET - 1

PER DOOR:

| | | |
|------------------------|---------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 CLOSER | C02021 PT4C | 689 |
| 1 THRESHOLD | 171A - 36" | 689 |
| 1 DOOR BOTTOM | 216AV - 36" | 689 |
| 1 SET WEATHERSTRIPPING | 305AN - 36" X 84" | 689 |
| 1 STOP | as required | 626 |

CONTROL TOWERSET - 1

PER DOOR:

| | | |
|------------------------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 CLOSER | C02021 PT4C | 689 |
| 1 THRESHOLD | 171A - 36" | 689 |
| 1 DOOR BOTTOM | 216AV - 36" | 689 |
| 1 SET WEATHERSTRIPPING | 305AN - 36" X 84" | 689 |
| 1 STOP | as required | 626 |

HEADQUARTERS BUILDING/GENERAL INSTRUCTION BUILDING/
RANGE SUPPORT BUILDING/TOOL PARTS STORAGE BUILDINGSET - 1

PER DOOR:

| | | |
|------------------------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 CLOSER | C02021 PT4C | 689 |
| 1 THRESHOLD | 181A - 36" | 689 |
| 1 SET WEATHERSTRIPPING | 305AN - 36" X 84" | 689 |
| 1 STOP | as required | 626 |

SET - 2

PER DOOR:

| | | |
|-----------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 STOP | AS REQUIRED | 626 |

HEADQUARTERS BUILDING/GENERAL INSTRUCTION BUILDING/
RANGE SUPPORT BUILDING/TOOL PARTS STORAGE BUILDING

SET - 3

PER DOOR:

| | | |
|------------------------|-------------------------|-----|
| 6 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 THRESHOLD | 171A - LAR | 689 |
| 2 FLUSHBOLTS | 1356 - 12" | 626 |
| 1 SET WEATHERSTRIPPING | 305AN - LAR | 689 |

LATRINE/SHOWER BUILDING

SET - 1

PER DOOR:

| | | |
|--------------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 630 |
| 1 PUSH PLATE | J300 | 630 |
| 1 PULL PLATE | J400 | 630 |
| 1 KICKPLATE | J102 8" X 2" LDW | 630 |
| 1 CLOSER | C02011 PT4C | 689 |
| 1 STOP | as required | 630 |
| 1 THRESHOLD | 171A - 36" | 689 |
| 1 DEADLOCK | 1000 - F23 | 630 |

SET - 2

PER DOOR:

| | | |
|------------------------|-------------------------|-----|
| 6 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 THRESHOLD | 171A - LAR | 689 |
| 2 FLUSHBOLTS | 1356 - 12" | 626 |
| 1 SET WEATHERSTRIPPING | 305AN - LAR | 689 |

LATRINES

SET - 1

PER DOOR:

| | | |
|--------------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 630 |
| 1 PUSH PLATE | J300 | 630 |
| 1 PULL PLATE | J400 | 630 |
| 1 KICKPLATE | J102 8" X 2" LDW | 630 |
| 1 CLOSER | C02021 PT4C | 689 |
| 1 STOP | as required | 630 |
| 1 THRESHOLD | 181A - 36" | 630 |
| 1 DEADLOCK | 1000 - F23 | 630 |

AMMUNITION BUILDINGSSET - 1

PER DOOR:

| | | |
|------------------------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 LOCKSET | 1000 - F13 | 626 |
| 1 CLOSER | C02021 PT4C | 689 |
| 1 STOP | as required | 626 |
| 1 THRESHOLD | 181AV - 36" | 689 |
| 1 SET WEATHERSTRIPPING | 305AN - 36" X 84" | 689 |

TENT FRAMESET - 1

PER DOOR:

| | | |
|-----------|-------------------------|-----|
| 3 HINGES | A2112 4-1/2 X 4-1/2 NRP | 626 |
| 1 HASP | 941 - 7-1/2" | 626 |
| 1 PADLOCK | 756HSC | --- |
| 1 CLOSER | C02021 PT4C | 689 |

SECURITY GATE

PER GATE:

| | |
|-----------|---------|
| 2 Padlock | 756 HSC |
|-----------|---------|

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 08 - DOORS & WINDOWS

SECTION 08810

GLASS AND GLAZING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SYSTEM DESCRIPTION
- 1.4 DELIVERY, STORAGE AND HANDLING
- 1.5 PROJECT/SITE CONDITIONS
- 1.6 WARRANTY
 - 1.6.1 Insulating Glass
 - 1.6.2 Control Tower Insulating Glass

PART 2 PRODUCTS

- 2.1 ROLLED GLASS
 - 2.1.1 Patterned Glass (Figured)
 - 2.1.2 Wired Glass
- 2.2 INSULATING WINDOW GLASS
 - 2.2.1 Clear Tempered Insulating Glass
 - 2.2.2 Patterned Insulating Glass (Figured)
- 2.3 HEAT-TREATED GLASS
 - 2.3.1 Tempered Glass
- 2.4 MIRRORS
 - 2.4.1 Glass Mirrors
 - 2.4.2 Mirror Accessories
 - 2.4.2.1 Mastic
 - 2.4.2.2 Mirror Frames
 - 2.4.2.3 Mirror Clips
- 2.5 CONTROL TOWER GLASS
 - 2.5.1 Control Tower Insulating Glass
 - 2.5.1.1 Control Tower Heat-Absorbing Insulating Glass
- 2.6 GLAZING ACCESSORIES
 - 2.6.1 Preformed Tape
 - 2.6.2 Sealant
 - 2.6.3 Glazing Gaskets
 - 2.6.3.1 Fixed Glazing Gaskets
 - 2.6.3.2 Wedge Glazing Gaskets
 - 2.6.3.3 Aluminum Framing Glazing Gaskets
 - 2.6.4 Putty and Glazing Compound
 - 2.6.5 Setting and Edge Blocking

PART 3 EXECUTION

- 3.1 PREPARATION
- 3.2 INSTALLATION
- 3.3 CLEANING
- 3.4 PROTECTION

-- End of Section Table of Contents --

SECTION 08810

GLASS AND GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|------------|---|
| ANSI Z97.1 | (1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings |
|------------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM C 509 | (1994) Elastomeric Cellular Preformed Gasket and Sealing Material |
| ASTM C 669 | (1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash |
| ASTM C 864 | (1993) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers |
| ASTM C 920 | (1995) Elastomeric Joint Sealants |
| ASTM C 1036 | (1991) Flat Glass |
| ASTM C 1048 | (1992) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass |
| ASTM D 395 | (1989; R 1994) Rubber Property - Compression Set |
| ASTM E 773 | (1988) Seal Durability of Sealed Insulating Glass Units |
| ASTM E 774 | (1992) Sealed Insulating Glass Units |
| ASTM E 1300 | (1994) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load |

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

| | |
|--------|--|
| ASCE 7 | (1995) Minimum Design Loads for Buildings and Other Structures |
|--------|--|

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-378 (Basic) Putty Linseed Oil Type, (for Wood-Sash-Glazing)

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA-01 (1997) Glazing Manual

GANA-04 (1995) Engineering Standards Manual
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1995) Fire Doors and Fire Windows

NFPA 252 (1995) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Glass; GA Glazing Accessories; GA

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

Control Tower Glazing Units; GA

Drawing showing complete details of the proposed setting methods and materials.

SD-13 Certificates

Glass; GA

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

Control Tower Glazing Units; GA

Certificates from the manufacturer attesting that the units meet the luminous and solar radiant transmission requirements for heat absorbing glass.

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's

unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 40 degrees F and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

1.6 WARRANTY

1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

1.6.2 Control Tower Insulating Glass

Manufacturer shall warrant the control tower insulating glass to be free of fogging or film formation on the internal glass surfaces for a period of one year from Date of Substantial Completion. Warranty shall be signed by manufacturer.

PART 2 PRODUCTS

2.1 ROLLED GLASS

2.1.1 Patterned Glass (Figured)

Patterned glass shall be Type II flat type. Class 1 - translucent, Finish f2 - patterned both sides, Quality q7 - decorative conforming to ASTM C 1036.

2.1.2 Wired Glass

Wired glass shall be Type II flat type, Class 1 - translucent, Quality q8 - glazing, Form 1 - wired and polished both sides, conforming to ASTM C 1036.

Wire mesh shall be polished stainless steel Mesh 1 - diamond. Wired glass for fire-rated windows shall bear an identifying UL label or the label of a nationally recognized testing agency. Wired glass for fire-rated doors shall be tested as part of a door assembly in accordance with NFPA 252.

2.2 INSULATING WINDOW GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum, steel, or stainless steel, spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. The insulating

glass unit shall be a total thickness of 5/8 inch consisting of two (2) 1/8 inch thick panels and a 3/8 inch air space. Glass types shall be as follows:

2.2.1 Clear Tempered Insulating Glass

Glass for two-pane insulating units shall be fully tempered transparent flat type, Class 1 - clear, Condition A Uncoated Surface, Quality q3 - glazing select, conforming to ASTM C 1036.

2.2.2 Patterned Insulating Glass (Figured)

Interior and exterior glass panes for patterned insulating units shall be Type II flat type glass, Class 1-translucent, Quality q7 - decorative, Finish f2 patterned both sides conforming with ASTM C 1036.

2.3 HEAT-TREATED GLASS

Heat-treated glass shall conform to the following requirements.

2.3.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type, Class 1-clear, Condition A uncoated surface, Quality q3 - glazing select, conforming to ASTM C 1048 and GANA-04.

2.4 MIRRORS

2.4.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.4.2 Mirror Accessories

2.4.2.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.4.2.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 1-1/4 x 1/4 x 1/4 inch continuous at top and bottom of

mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.4.2.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

2.5 CONTROL TOWER GLASS

Control tower glass units shall be of sizes required to properly fit aluminum frames. Tolerances and clearances for units shall be designed to prevent the transfer of stress in aluminum frames to the glass. Resilient setting blocks, spacer strips, clips, bolts, washers, angles, glazing sealants, and resilient channels or cemented-on-materials shall be of the type recommended in the glass manufacturer's approved written instructions. Edges and corners of units shall not be ground, nipped, cut, or fitted after leaving the factory.

2.5.1 Control Tower Insulating Glass

Insulating glass units for air traffic control towers shall meet the wind load design requirement of 100 psi, as determined in accordance with ASCE 7.

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of two lites of glass separated by a dark bronze aluminum, steel, or stainless steel, spacer with desiccant and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints, to completely seal the spacer periphery to eliminate moisture and hydrocarbon vapor transmission into airspace through corners. Primary seal shall be compressed polyisobutylene. Secondary seal shall be silicone. Insulating glass units shall be fabricated for use at an elevation of as shown. Within bottom 1/3 of one of the vertical edges of each unit, the manufacturer shall install an open 12 inch long capillary/breather tube for pressure equalization. The insulating glass units shall be free of parallax or optical distortions. The manufacturer's identifying label shall be permanently affixed to both exterior surfaces of the glass units. The insulating glass units shall be a total thickness of 1 inch consisting of two 1/4 inch thick panels and air space, or a total thickness of 1-1/4 inch consisting of two 3/8 inch thick panels and air space, or a total thickness of 1-1/2 inch consisting of two 1/2 inch thick panels and an air space, as required to meet the wind loads indicated. Glass type shall be as follows.

2.5.1.1 Control Tower Heat-Absorbing Insulating Glass

Heat-absorbing insulating glass shall consist of two glass panels separated by an air space and shall conform to ASTM C 1036, fully-tempered, transparent flat type, Condition A Uncoated Surface, Quality q3 - glazing select. Interior glass shall be Class 1-clear and exterior glass shall be Class 2-tinted grey. Glass performance shall be minimum Visible Transmittance of 70.8 percent for each panel and R-Value of 1.85 for the unit.

2.6 GLAZING ACCESSORIES

2.6.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a

width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

2.6.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass.

2.6.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.6.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

2.6.3.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

2.6.3.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.6.4 Putty and Glazing Compound

Glazing compound shall conform to ASTM C 669 for face-glazing metal sash. Putty shall be linseed oil type conforming to CID A-A-378 for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.6.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined

for compliance with approved shop drawings, GANA-01 and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA-01, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and fire/safety rated glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Fire-Rated Construction
 - 1.2.2 Pressurized Enclosures
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE AND HANDLING
- 1.5 ENVIRONMENTAL CONDITIONS

PART 2 MATERIALS

- 2.1 NON-LOADBEARING STUD WALLS
 - 2.1.1 Studs
 - 2.1.2 Runner Tracks
- 2.2 SUSPENDED CEILING FRAMING
- 2.3 GYPSUM BOARD
 - 2.3.1 Standard Gypsum Board
 - 2.3.2 Fire-Rated Gypsum Board
 - 2.3.3 Water-Resistant Gypsum Board
 - 2.3.4 Exterior Gypsum Soffit Board
 - 2.3.5 Exterior Sheathing Board
- 2.4 TRIM, MOLDINGS, AND ACCESSORIES
 - 2.4.1 Taping and Embedding Compound
 - 2.4.2 Finishing or Topping Compound
 - 2.4.3 All-Purpose Compound
 - 2.4.4 Joint Tape
 - 2.4.5 Trim, Control Joints, Beads, Stops and Nosings
- 2.5 FASTENINGS AND ADHESIVES
 - 2.5.1 Nails
 - 2.5.2 Screws
 - 2.5.3 Adhesives
 - 2.5.4 Hangers
 - 2.5.5 Wire and Clip Type Fastenings
 - 2.5.5.1 Tie Wire
 - 2.5.5.2 Clips

PART 3 EXECUTION

- 3.1 INTERIOR WALL FRAMING
 - 3.1.1 Wall Openings
 - 3.1.2 Wall Control Joints
- 3.2 SUSPENDED CEILING FRAMING
 - 3.2.1 Hangers
 - 3.2.2 Main Runners
 - 3.2.3 Furring Channels

- 3.2.4 Ceiling Openings
- 3.2.5 Light Fixtures
- 3.2.6 Control Joints
 - 3.2.6.1 Interior Ceilings With Perimeter Relief
 - 3.2.6.2 Interior Ceilings Without Perimeter Relief
 - 3.2.6.3 Exterior Ceilings
- 3.3 APPLICATION OF GYPSUM BOARD
 - 3.3.1 Backing Board
 - 3.3.2 Exterior Gypsum Sheathing
- 3.4 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION
- 3.5 TAPING AND FINISHING
- 3.6 FIRE-RESISTANT ASSEMBLIES
- 3.7 PATCHING

-- End of Section Table of Contents --

SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM A 580 | (1995a) Stainless and Heat Resisting Steel Wire |
| ASTM A 853 | (1993) Steel Wire, Carbon, for General Use |
| ASTM C 36 | (1995) Gypsum Wallboard |
| ASTM C 79 | (1994) Gypsum Sheathing Board |
| ASTM C 475 | (1994) Joint Compound and Joint Tape for Finishing Gypsum Board |
| ASTM C 514 | (1996) Nails for the Application of Gypsum Board |
| ASTM C 557 | (1993a) Adhesive for Fastening Gypsum Wallboard to Wood Framing |
| ASTM C 630 | (1996a) Water-Resistant Gypsum Backing Board |
| ASTM C 645 | (1995) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board |
| ASTM C 754 | (1996) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board |
| ASTM C 840 | (1996) Application and Finishing of Gypsum Board |
| ASTM C 931 | (1995) Exterior Gypsum Soffit Board |
| ASTM C 1002 | (1996a) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases |
| ASTM C 1047 | (1994) Accessories for Gypsum Wallboard and Gypsum Veneer Base |

GYPSUM ASSOCIATION (GA)

GA 216 (1996) Application and Finishing of Gypsum Board

GA 600 (1994) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL-05 (1997) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

1.2.2 Pressurized Enclosures

Pressurized fire-rated gypsum board enclosures shall allow the mechanical and electrical life-safety systems to operate in accordance with the design intent. Air pressure within elevator shaft shall be 7.5 psf. Air pressure within stair shaft shall be 5.0 psf. Maximum mid-span deflection shall be L/360.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Steel Framing; GA. Control Joints; GA. Fire-Resistant Assemblies; GA

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

SD-13 Certificates

Gypsum Wallboard; GA. Water-Resistant Gypsum Board; GA. Steel Framing; GA. Fire-Rated Gypsum Board; GA

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials

shall be removed from jobsite.

1.5 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 40 degrees F shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 50 degrees F shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

PART 2 MATERIALS

2.1 NON-LOADBEARING STUD WALLS

2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness of 0.0179 in made from G40 hot-dip galvanized coated sheet.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 1 inch flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

2.2 SUSPENDED CEILING FRAMING

Carrying channels shall be formed from 0.0548 in thick cold-rolled steel, 1-1/2 x 3/4 inch. Furring members shall be formed from cold-rolled steel, 7/8 x 2-9/16 inch. Carrying channels and furring members shall be made from hot-dip galvanized coated sheet.

2.3 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown.

2.3.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36, and shall be 48 inches wide.

2.3.2 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to ASTM C 36, and shall be Type X or Type C as required, 48 inches wide.

2.3.3 Water-Resistant Gypsum Board

Water-resistant gypsum board shall conform to ASTM C 630, regular, with water-resistant paper faces, paintable surfaces, and shall be 48 inch width and maximum permissible length. Water-resistant gypsum board shall not be used on ceilings.

2.3.4 Exterior Gypsum Soffit Board

Exterior gypsum soffit board shall conform to ASTM C 931, regular, 48 inches wide.

2.3.5 Exterior Sheathing Board

Exterior sheathing board shall conform to ASTM C 79, Type X, shall have water-resistant core, water-repellant paper faces each side, with tongue-and-groove edges, and be 24 inches wide, or square edges and 48 inches wide.

2.4 TRIM, MOLDINGS, AND ACCESSORIES

2.4.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.4.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.4.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.4.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

2.4.5 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with ASTM C 1047.

2.5 FASTENINGS AND ADHESIVES

2.5.1 Nails

Nails shall conform to ASTM C 514. Nails shall be hard-drawn low or medium-low carbon steel, suitable for intended use. Special nails for predecorated gypsum board shall be as recommended by predecorated gypsum board manufacturer.

2.5.2 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type S for wood or light-gauge steel framing.

2.5.3 Adhesives

Adhesives shall conform to ASTM C 557. Adhesives shall be formulated to bond gypsum board to wood framing members. For securing gypsum board to metal framing, adhesive shall be as recommended by gypsum board manufacturer.

2.5.4 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than No. 8 SWG, conforming to ASTM A 853.

2.5.5 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580, composition 302, 304, or 316, Condition A, except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

2.5.5.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than No. 18 SWG. Tie wire for other applications shall be not less than No. 16 SWG.

2.5.5.2 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than $\frac{1}{8}$ inch thick or shall be hairpin clip, formed of wire not less than 0.01620 inch nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 30 inches wide. Studs at openings shall be 0.0329 in minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners.

3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed $\frac{1}{2}$ inch apart in interior walls or wall furrings where indicated on drawings. Control joint spacing shall not exceed 30 feet. Ceiling-height door frames may be used as vertical

control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation in fire rated partitions.

3.2 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

3.2.1 Hangers

Hangers shall be spaced not more than 48 inches along runner channels and 36 inches in the other direction or 42 inches in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 6 inches from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, or secured to structural elements with suitable fasteners. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

3.2.2 Main Runners

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 6 inches of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 12 inches with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

3.2.3 Furring Channels

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 2 inches of parallel walls and beams, and shall be cut 1/2 inch short of abutting walls.

3.2.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 1-1/2 inch main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

3.2.5 Light Fixtures

Light fixtures shall not be supported directly from suspended ceiling runners. Hanger wires for recessed or surface mounted light fixtures shall be anchored to structure at four corners of light fixtures, and additional wires shall be provided at appropriate locations to carry the weight of light fixtures.

3.2.6 Control Joints

Ceiling control joints for expansion and contraction shall be located where indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

3.2.6.1 Interior Ceilings With Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 50 feet in either direction nor more than 2500 square feet.

3.2.6.2 Interior Ceilings Without Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 30 feet in either direction nor more than 900 square feet.

3.2.6.3 Exterior Ceilings

Control joints shall be installed so the linear dimensions between control joints shall not exceed 30 feet in either direction nor more than 900 square feet.

3.3 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840 and GA 216 and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions.

3.3.1 Backing Board

Gypsum board and water-resistant gypsum backing board used as a substrate to receive ceramic tile shall be in accordance with ASTM C 840, System X.

3.3.2 Exterior Gypsum Sheathing

Exterior gypsum sheathing shall be flashed at openings so that water intrusion will not contact the sheathing. Vertical end and edge joints shall abut over the centers of framing members and shall be offset a minimum of one framing space between adjacent rows of gypsum sheathing. Sheathing shall be installed in accordance with manufacturer's instructions.

3.4 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

3.5 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with

ASTM C 840. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

3.6 FIRE-RESISTANT ASSEMBLIES

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with UL-05, or GA 600 for the design number indicated on drawings.

3.7 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09900

PAINTING, GENERAL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 PACKAGING, LABELING, AND STORING
- 1.4 APPROVAL OF MATERIALS
- 1.5 ENVIRONMENTAL CONDITIONS
- 1.6 SAFETY AND HEALTH
 - 1.6.1 Worker Exposures
 - 1.6.2 Toxic Compounds
 - 1.6.3 Training
 - 1.6.4 Coordination

PART 2 PRODUCTS

- 2.1 PAINT
 - 2.1.1 Colors and Tints
 - 2.1.2 Mildewcide and Insecticide
 - 2.1.3 Lead
 - 2.1.4 Chromium
 - 2.1.5 Volatile Organic Compound (VOC) Content

PART 3 EXECUTION

- 3.1 PROTECTION OF AREAS NOT TO BE PAINTED
- 3.2 SURFACE PREPARATION
 - 3.2.1 Concrete, Stucco and Masonry Surfaces
 - 3.2.2 Ferrous Surfaces
 - 3.2.3 Nonferrous Metallic Surfaces
 - 3.2.4 Gypsum Board Surfaces
 - 3.2.5 Mastic-Type Surfaces
 - 3.2.6 Plaster Surfaces
 - 3.2.7 Wood Surfaces
 - 3.2.7.1 Interior Wood Stain
 - 3.2.8 Previously Painted Surfaces
- 3.3 MIXING AND THINNING
 - 3.3.1 Two-Component Systems
- 3.4 APPLICATION
 - 3.4.1 Ventilation
 - 3.4.2 Respirators
 - 3.4.3 First Coat
 - 3.4.4 Timing
 - 3.4.5 Stains
 - 3.4.6 Fillers
 - 3.4.6.1 Latex Filler
 - 3.4.7 Textured Coating

- 3.4.8 Ferrous-Metal Primer
- 3.5 PIPE COLOR CODE MARKING
- 3.6 MISCELLANEOUS PAINTING
 - 3.6.1 Lettering
- 3.7 SURFACES TO BE PAINTED
- 3.8 CLEANING
- 3.9 PAINTING SCHEDULES

-- End of Section Table of Contents --

SECTION 09900

PAINTING, GENERAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

| | |
|----------|---|
| ACGIH-02 | (1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices |
|----------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM D 3273 | (1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber |
| ASTM D 3274 | (1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation |
| ASTM D 4214 | (1989) Evaluating the Degree of Chalking of Exterior Paint Films |
| ASTM D 4258 | (1988; R 1992) Surface Cleaning Concrete for Coating |

COMMERCIAL ITEM DESCRIPTIONS (CID)

| | |
|--------------|--|
| CID A-A-1500 | (Rev A) Sealer, Surface (Latex Block Filler) |
| CID A-A-1788 | (Basic) Varnish, Oil: Interior |
| CID A-A-2246 | (Rev A) Paint, Latex (Gloss, Interior) |
| CID A-A-2247 | (Basic) Paint, Latex (Semigloss, Interior) |
| CID A-A-2248 | (Basic) Paint, Latex, (Flat, Interior) |
| CID A-A-2336 | (Rev A) Primer Coating (Alkyd, Exterior Wood, White and Tints) |
| CID A-A-2542 | (Basic) Sealer, Terrazzo and Concrete Floors, Waterbased |
| CID A-A-2867 | (Basic) Coating, Polyurethane, Single |

Component Moisture Cure, Alipathic

CID A-A-2962

(Basic) Enamel, Alkyd

CID A-A-2994

(Basic) Primer Coating, Interior, for
Walls and Wood

FEDERAL SPECIFICATIONS (FS)

FS TT-C-555

(Rev B; Am 1) Coating, Textured (for
Interior and Exterior Masonry Surfaces)

FS TT-E-2784

(Rev A) Enamel (Acrylic-Emulsion, Exterior
Gloss and Semigloss) (Metric)

FS TT-P-28

(Rev G) Paint, Aluminum, Heat Resisting
(1200 Degrees F.)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 5

(1995) Zinc Dust, Zinc Oxide and Phenolic
Varnish Paint

SSPC Paint 20

(1991) Zinc-Rich Primers (Type I -
Inorganic and Type II - Organic)

SSPC Paint 23

(1982) Latex Primer for Steel surfaces

SSPC Paint 25

(1991) Red Iron Oxide, Zinc Oxide, Raw
Linseed Oil and Alkyd Primer (Without Lead
and Chromate Pigments)

SSPC SP 1

(1982) Solvent Cleaning

SSPC SP 2

(1995) Hand Tool Cleaning

SSPC SP 3

(1995) Power Tool Cleaning

SSPC SP 6

(1994) Commercial Blast Cleaning

SSPC SP 7

(1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Paint; GA

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 50 gallons or less.

SD-06 Instructions

Mixing and Thinning; GAApplication; GA

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-09 Reports

Paint; GA

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 50 gallons:

- a. A test report showing that the proposed batch to be used meets specified requirements:
- b. A test report showing that a previous batch of the same formulation as the batch to be used met specified requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per gallon, viscosity, fineness of grind, drying time, color, and gloss.

SD-13 Certificates

Lead; GA Mildewcide and Insecticide; GA Volatile Organic Compound (VOC) Content; GA

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons.

Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports

furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings.

Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH-02, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

2.1.3 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Concrete, Stucco and Masonry Surfaces

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.2.5 Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

3.2.6 Plaster Surfaces

Plaster shall age at least 30 days before painting. Plaster shall be clean and free from loose matter and shall have an instrument-measured moisture content not exceeding 8 percent.

3.2.7 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless

otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

3.2.7.1 Interior Wood Stain

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

3.2.8 Previously Painted Surfaces

Previously painted surfaces damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas. Edges of chipped paint shall be feather edged and sanded smooth. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting. Chalk shall be removed so that when tested in accordance with ASTM D 4214, the chalk resistance rating is no less than 8. New, proposed coatings shall be compatible with existing coatings. If existing surfaces are glossy, the gloss shall be reduced.

3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local

laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 70 mils all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Stains

Stain shall be applied at the rate specified in the manufacturer's printed directions. Oil-type stain shall be applied by brushing with the grain for the full length of the board or course of siding.

3.4.6 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

3.4.6.1 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and excess filler shall be removed from the surface with a rubber squeegee. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

3.4.7 Textured Coating

Application of textured coating, FS TT-C-555, shall be as specified in the manufacturer's printed directions.

3.4.8 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 40 foot spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

TABLE I. COLOR CODES FOR MARKING PIPE

| Material | Letters and | | Legend |
|------------------------------------|-------------|--------|----------------|
| | Band | Arrow* | |
| Cold water (potable) | Green | White | POTABLE WATER |
| Fire protection water | Red | White | FIRE PR. WATER |
| Hot water (domestic) | Green | White | H.W. |
| Hot water recirculating (domestic) | Green | White | H.W.R. |
| High temp. water supply | Yellow | Black | H.T.W.S. |

TABLE I. COLOR CODES FOR MARKING PIPE

| Material | Letters and | | Legend |
|----------------------------------|-------------|--------|------------|
| | Band | Arrow* | |
| High temp. water return | Yellow | Black | H.T.W.R. |
| Boiler feed water | Yellow | Black | B.F. |
| Low temp. water supply (heating) | Yellow | Black | L.T.W.S. |
| Low temp. water return (heating) | Yellow | Black | L.T.W.R. |
| Condenser water supply | Green | White | COND. W.S. |
| Condenser water return | Green | White | COND. W.R. |
| Chilled water supply | Green | White | C.H.W.S. |
| Chilled water return | Green | White | C.H.W.R. |
| Treated water | Yellow | Black | TR. WATER |
| Chemical feed | Yellow | Black | CH. FEED |
| Compressed air | Yellow | Black | COMP. AIR |
| Natural gas | Blue | White | NAT. GAS |
| Freon | Blue | White | FREON |
| Fuel oil | Yellow | Black | FUEL OIL |
| Steam | Yellow | Black | STM. |
| Condensate | Yellow | Black | COND. |

TABLE II. COLOR CODE MARKING SIZES

| Outside Diameter of Pipe Covering (Inches) | Length of Color Band (inches) | Arrow | Size of Legend |
|--|-------------------------------------|----------------------------|----------------------------------|
| | | Length x Width (Inches) | Letters and Numerals (Inches) |
| Less than 1-1/2 | 8 | 8 x 2-1/4 | 1/2 |
| 1-1/2 to 2-3/8 | 8 | 8 x 2-1/4 | 3/4 |
| 2-1/2 to 7-7/8 | 12 | 8 x 2-1/4 | 1-1/4 |
| 8 to 10 | 24 | 12 x 4-1/2 | 2-1/2 |
| Over 10 | 32 | 12 x 4-1/2 | 3-1/2 |

3.6 MISCELLANEOUS PAINTING

3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel. Samples shall be approved before application.

3.7 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

3.8 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

3.9 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

EXTERIOR PAINTING SCHEDULE

| <u>Surface</u> | <u>First Coat</u> | <u>Second Coat</u> | <u>Third Coat</u> |
|---|-------------------------------------|-----------------------|---------------------|
| Concrete masonry units. | Cement-emulsion filler as specified | As specified below | None |
| <hr/> | | | |
| First Coat: | | | |
| Thoro "intermix" cementitious acrylic-modified waterproof blockfiller by Thorosystem products, or approved equal; brush or spray apply first coat. Apply at a rate of 100 square feet per gallon. | | | |
| Second Coat: | | | |
| Thorocoat decorative coating by Thorosystem products or approved equal. Spray applied, minimum wet film thickness 9.0 mils per coat. | | | |
| <hr/> | | | |
| Concrete, unless otherwise specified. | FS TT-E-2784 Type III | FS TT-E-2784 Type III | None |
| <hr/> | | | |
| Wood, unless otherwise specified. | CID A-A-2336 | FS TT-E-2784 Type 1 | FS TT-E-2784 Type 1 |
| <hr/> | | | |
| Ferrous metal unless otherwise | SSPC Paint 5 | CID A-A-2962 Type I | CID A-A-2962 Type 1 |
| | SSPC Paint 25 | CID A-A-2962 Type I | CID A-A-2962 Type 1 |
| <hr/> | | | |
| Ferrous metal: subject to high temperature, up to 232 degrees C (450 degrees F) | SSPC Paint 20 Type I | None | None |
| <hr/> | | | |
| Ferrous metal: subject to high temperature, from | FS TT-P-28 | FS TT-P-28 | None |

EXTERIOR PAINTING SCHEDULE

| <u>Surface</u> | <u>First Coat</u> | <u>Second Coat</u> | <u>Third Coat</u> |
|--|-------------------|--------------------|-------------------|
| 232 degrees C to 649 degrees C (450 degrees F to 1200 degrees F) | | | |

NOTE: Commercial blast-cleaning, SSPC SP 6 required.
No pretreatment. Maximum total system thickness:
4 mil.

| | | | |
|----------------------|--------------------------|------------------------|------------------------|
| Galvanized metal. | FS TT-E-2784 Type III | FS TT-E-2784 Type 1 | FS TT-E-2784 Type 1 |
|----------------------|--------------------------|------------------------|------------------------|

| | | | |
|--|--------------------------|------------------------|------------------------|
| Aluminum aluminum-alloy, and other non- ferrous metal (non-galvanized) | CID A-A-2867 | CID A-A-2867 | None |
| | FS TT-E-2784 Type III | FS TT-E-2784 Type 1 | FS TT-E-2784 Type 1 |

Aviation Obstructions

| | | | |
|-----------------------|--------------------------|------------------------|------|
| Masonry & Concrete | FS TT-E-2784 Type III | FS TT-E-2784 Type I | None |
|-----------------------|--------------------------|------------------------|------|

Aviation Obstructions

| | | | |
|------------------|---------------|---------------------------------------|---------------------------------------|
| Ferrous Metal | SSPC Paint 25 | CID A-A-2962 Type I Grade C | CID A-A-2962 Type I Grade C |
| | CID A-A-2867 | CID A-A-2867 | None |
| | SSPC Paint 23 | FS TT-E-2784 Type I | FS TT-E-2784 Type I |

INTERIOR PAINTING SCHEDULE

| <u>Surface</u> | <u>First Coat</u> | <u>Second Coat</u> | <u>Third Coat</u> |
|---|---|-------------------------|------------------------|
| Plaster, gypsum board, concrete, and concrete masonry units not requiring a smooth finish, unless otherwise specified. | CID A-A-2994 Type II | CID A-A-2246 | None |
| | | -----or----- | |
| | | CID A-A-2247 | None |
| | | -----or----- | |
| | | CID A-A-2248 | None |
| Concrete masonry units requiring a smooth finish | CID A-A-1500 | CID A-A-2994 Type II | CID A-A-2246 |
| | | | -----or----- |
| | | | CID A-A-2247 |
| | | | -----or----- |
| | | | CID A-A-2248 |
| Concrete: ceilings | Primer as recommended by FS TT-C-555 manufacturer | FS TT-C-555 Type I | None |
| Concrete: floors requiring dust reduction | CID A-A-2542 Type I | None | None |
| Concrete masonry units: in, shower areas, and areas requiring a high degree of sanitation, unless otherwise specified. | CID A-A-1500 | CID A-A-2994 Type II | FS TT-E-2784 Type 1 |
| Plaster and gypsum board: in shower areas, and areas requiring a high degree of sanitation, unless otherwise specified. | CID A-A-2994 Type II | FS TT-E-2784 Type 1 | None |

INTERIOR PAINTING SCHEDULE

| <u>Surface</u> | <u>First Coat</u> | <u>Second Coat</u> | <u>Third Coat</u> |
|--|---|--|--|
| Concrete masonry units, plaster, and gypsum board: for walls in heavy traffic areas in space as follows: | CID A-A-1500 | CID A-A-2994 Type II | CID A-A-2246 -----or----- CID A-A-2247 |
| Hardboard. | CID A-A-2994 Type I | CID A-A-2246 -----or----- CID A-A-2247 -----or----- CID A-A-2248 | CID A-A-2246 -----or----- CID A-A-2247 -----or----- CID A-A-2248 |
| Ferrous Metal unless otherwise specified | SSPC Paint 25 | CID A-A-2962 Type I | CID A-A-2962 Type I |
| Ferrous metal factory-primed mechanical and electrical equipment. | Two coats of paint as recommended by the equipment manufacturer | | None |
| Galvanized metal: | SSPC Paint 25 | CID A-A-2962 Type I Grade C | CID A-A-2962 Type I Grade C |
| Wood: unless otherwise specified. | CID A-A-2994 Type I | CID A-A-2246 -----or----- CID A-A-2247 -----or----- CID A-A-2248 | None -----or----- None -----or----- None |
| Wood: stain and varnish finishes | Commercially available stain | CID A-A-1788 Class I | CID A-A-1788 Class I |
| Ferrous Metal: Convactor enclosures, electrical conduit runs: | SSPC Paint 23 | None | None |

INTERIOR PAINTING SCHEDULE

| Surface | <u>First Coat</u> | <u>Second Coat</u> | <u>Third Coat</u> |
|--|--|--------------------|-------------------|
| metallic tubing uninsulated ducts and pipes, pipe hangers, louvers, grilles, and air outlets, in areas having painted adjacent surfaces. | | | |
| <hr/> | | | |
| Aluminum and Galvanized Surface Metal: | | | |
| Convactor | FS TT-E-2784 | CID A-A-2246 | CID A-A-2246 |
| enclosures, | | -----or----- | |
| electrical | | CID A-A-2247 | CID A-A-2247 |
| conduit runs | | -----or----- | |
| metallic tubing | | CID A-A-2248 | CID A-A-2248 |
| uninsulated ducts and pipes, pipe hangers, louvers, grilles, and air outlets, in areas having painted adjacent surfaces. | | | |
| <hr/> | | | |
| Metal: surfaces subject to high temperature, up to 232 degrees C (450 degrees F). | SSPC Paint 20 Type I | None | None |
| <hr/> | | | |
| Metal: surfaces subject to temperature from 232 degrees C to 649 degrees C (450 degrees F to 1200 degrees F), | FS TT-P-28 | FS TT-P-28 | None |
| NOTE: Commercial blast-cleaning, SSPC SP 6 or better required. No pretreatment. Maximum total dry film thickness: 4 mil. | | | |
| <hr/> | | | |
| Facing of vapor barrier jackets of presized or adhesive finished cloth cover insulation on pipes, ducts, | Two coats of paint to match adjacent areas | | None |

INTERIOR PAINTING SCHEDULE

| <u>Surface</u> and equipment in following area. | <u>First Coat</u> | <u>Second Coat</u> | <u>Third Coat</u> |
|---|-------------------|--------------------|-------------------|
|---|-------------------|--------------------|-------------------|

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 10 - SPECIALTIES

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 MANUFACTURED UNITS
 - 2.1.1 Anchors and Fasteners
 - 2.1.2 Finishes
- 2.2 ACCESSORY ITEMS
 - 2.2.1 Glass Mirrors
 - 2.2.2 Mirror, Metal (MM)
 - 2.2.3 Combination Paper Towel Dispenser/Waste Receptacle Units (PTDWR)
 - 2.2.4 Sanitary Napkin and Tampon Dispenser (SNTD)
 - 2.2.5 Shower Curtain (SC)
 - 2.2.6 Shower Curtain Rods (SCR)
 - 2.2.7 Soap Dispenser (SD)
 - 2.2.8 Shelf, Metal, Light Duty (SMLD)
 - 2.2.9 Soap and Grab Bar Combination, Recessed (SGR)
 - 2.2.10 Towel Bar (TB)
 - 2.2.11 Toilet Tissue Dispenser (TTD)

PART 3 EXECUTION

- 3.1 INSTALLATION

-- End of Section Table of Contents --

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2398 (Rev B) Curtain, Shower and Window (Metric - SI)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Finishes; GA Accessory Items; GA.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

SD-14 Samples

Finishes; GA Accessory Items; GA.

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-19 Operation and Maintenance Manuals

Electric Hand Dryer; GA

Four complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Each accessory item shall be complete with the necessary mounting plates, shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

| Metal | Finish |
|---------------------------------------|-------------------------|
| Stainless steel | No. 4 satin finish |
| Carbon steel, copper alloy, and brass | Chromium plated, bright |

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 1/4 inch thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.2 Mirror, Metal (MM)

Metal mirror shall be bright polished stainless steel or chromium plated steel, mirror quality, 0.037 inch minimum thickness, edges turned back 1/4 inch and recess fitted with tempered hardboard backing, and concealed theft-proof fasteners. Size shall be as shown.

2.2.3 Combination Paper Towel Dispenser/Waste Receptacle Units (PTDWR)

Dispenser/receptacle shall be semi-recessed and shall have a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 18 gallons. Unit shall be fabricated of not less than 0.30 inch stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.4 Sanitary Napkin and Tampon Dispenser (SNTD)

Sanitary napkin and tampon dispenser shall be surface mounted. Dispenser, including door shall be Type 304 stainless steel and shall dispense both napkins and tampons with a minimum capacity of 20 each. Dispensing mechanism shall be for complimentary operation. Doors shall be hung with a full-length corrosion-resistant steel piano hinge and secured with a tumbler lock.

2.2.5 Shower Curtain (SC)

Shower curtain shall conform to CID A-A-2398, Style I, size to suit conditions.

2.2.6 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 1-1/4 inch OD by 0.049 inch minimum straight to meet installation conditions.

2.2.7 Soap Dispenser (SD)

Soap dispenser shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps type constructed of stainless steel, shall contain a swap feed mechanism and an agitator designed to break up powdered soap, and shall have a minimum capacity of 32 ounces..

2.2.8 Shelf, Metal, Light Duty (SMLD)

Light duty metal shelf shall be supported between brackets or on brackets. Brackets shall prevent lateral movement of the shelf. Shelf shall be width of mirror units. Shelf and brackets shall be stainless steel.

2.2.9 Soap and Grab Bar Combination, Recessed (SGR)

Soap and grab bar combination shall be recessed type and shall be Type 304 stainless steel, satin finish. Provide one at each shower stall.

2.2.10 Towel Bar (TB)

Towel bar shall be stainless steel with a minimum thickness of .015 inch. Bar shall be minimum 3/4 inch diameter, or 5/8 inch square. Finish shall be satin. Provide where shown.

2.2.11 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of tissue mounted horizontally. Cabinet shall be stainless steel, satin finish.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 12 - FURNISHINGS

SECTION 12338

ARCHITECTURAL WOODWORK

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
 - 1.3.1 AWI Quality Standard
 - 1.3.2 Installer Qualifications
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 PROJECT CONDITIONS
 - 1.5.1 Conditioning
 - 1.5.2 Temperature and Humidity

PART 2 PRODUCTS

- 2.1 FABRICATION, GENERAL
 - 2.1.1 Wood Moisture Content
 - 2.1.2 Fabrication
 - 2.1.3 Pre-Cut Openings
 - 2.1.4 Measurements
- 2.2 ARCHITECTURAL CABINETS, WOOD
 - 2.2.1 Quality Standard
 - 2.2.2 Wood Cabinets for Opaque Finish
- 2.3 ARCHITECTURAL CABINETS, LAMINATE CLAD
 - 2.3.1 Quality Standard
 - 2.3.2 Laminate Clad Cabinets
- 2.4 CABINET HARDWARE AND ACCESSORY MATERIALS
 - 2.4.1 General
 - 2.4.2 Cabinet Hardware Schedule
 - 2.4.3 Hardware Standard
 - 2.4.4 Hardware Finishes
- 2.5 ARCHITECTURAL CABINET TOPS
 - 2.5.1 Quality Standard
 - 2.5.2 High Pressure Decorative Laminate
- 2.6 FASTENERS AND ANCHORS
 - 2.6.1 Screws
 - 2.6.2 Nails
 - 2.6.3 Anchors

PART 3 EXECUTION

- 3.1 PREPARATION
- 3.2 INSTALLATION
- 3.3 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION

-- End of Section Table of Contents --

SECTION 12338

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

| | |
|-------------|--------------------------|
| ANSI A156.9 | Cabinet Hardware |
| ANSI A208.1 | Mat-Formed Particleboard |

ARCHITECTURAL WOODWORK QUALITY STANDARDS

| | |
|----------|---|
| AWI 400A | Architectural Cabinets (Wood) |
| AWI 400B | Architectural Cabinets (Laminate Clad Cabinets) |
| AWI 400C | Architectural (Tops) |
| AWI 1700 | Installation of Architectural Woodwork (Interior) |

BUILDER'S HARDWARE MANUFACTURER'S ASSOCIATION

| | |
|-------------|---------------------------|
| BHMA A156.9 | Cabinet Hardware |
| BHMA 1301 | Hardware Finish Standards |

FEDERAL SPECIFICATIONS

| | |
|-------------|---|
| FS DD-G-451 | Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors and Other Uses). |
| FS FF-N-105 | (Rev. B; Am. 3; Int. Am. 4) Nails, Brads Staples and Spikes: Wire, Cut, and Wrought |
| FS FF-S-111 | Screws |

MILITARY SPECIFICATIONS

| | |
|-------------|------------------------------------|
| MIL-C-20709 | (Rev. D) Casework, Metal and Wood. |
|-------------|------------------------------------|

NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION

NEMA LD 3

High Pressure Decorative Laminate

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Casework and Accessories, GA.

Submit for each type of casework and accessory specified. Submit manufacturer's descriptive data and catalog cuts complete with descriptions of materials, finishes, fastening and anchoring devices, and appurtenances.

SD-04, Drawings

Base Cabinets, GA; Wall Cabinets, GA; Countertops, GA.

Submit samples in accordance with MIL-C-20709. Submit 6- by 8-inch sample section of countertop including splashback, in each material and type.

Plastic Laminate, GA; Low Pressure Laminate, GA.

Submit plastic samples of each color, pattern, and finish to the Contrating Officer. Submit for each finish color of low pressure laminate.

SD-13, Certificates

Certificates of Compliance

Submit in accordance with MIL-C-20709

1.3 QUALITY ASSURANCE

1.3.1 AWI Quality Standard

Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Instittue (AWI), except as otherwise indicated.

1.3.2 Installer Qualifications

Arrange for installation of architectural woodwork by a firm which can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage,

soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.5 PROJECT CONDITIONS

1.5.1 Conditioning

Woodwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

1.5.2 Temperature and Humidity

Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period.

PART 2 PRODUCTS

2.1 FABRICATION, GENERAL

2.1.1 Wood Moisture Content

Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

2.1.2 Fabrication

Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.

Ease edges to a 1/16" radius, for corners of cabinets and edges of solid wood (lumber) members less than 1" in nominal thickness, 1/8" radius for edges of rails and similar members over 1" in nominal thickness.

Complete fabrication, assembly, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.1.3 Pre-Cut Openings

Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use physical samples, templates or roughing-in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with water-resistant coating.

2.1.4 Measurements

Before proceeding with fabrication of woodwork required to be fitted to

other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

2.2 ARCHITECTURAL CABINETS, WOOD

2.2.1 Quality Standard

Comply with AWI 400A

2.2.2 Wood Cabinets for Opaque Finish

Comply the with following requirements:

Grade: Custom.

Type of Cabinet Construction: Flush overlay.

Plywood Species for Exposed Surfaces: Provide A/2 birch, rotary cut plywood. All edges shall be machine edge banded.

Species for Exposed Lumber Surfaces: Any close-grained hardwood listed in referenced woodworking standard.

Materials for Semi-Exposed Surfaces: Douglas Fir Plywood Grade A/B, A/D as applicable.

Concealed Surfaces: Millworkers's Option.

2.3 ARCHITECTURAL CABINETS, LAMINATE CLAD

2.3.1 Quality Standard

Comply with AWI 400B

2.3.2 Laminate Clad Cabinets

Comply with the following requirements:

Type of Cabinet Construction: Flush overlay.

Panel Construction:

Particleboard: ANSI A208.1 mat-formed particleboard, Grade 1-M-2 with minimum density of 45 lbs. per cu. ft., internal bond of 60 psi; and minimum screwholding capacity of 225 lbs. on faces and 200 lbs. on edges.

Exposed Laminate Cladding: High pressure decorative laminate complying with NEMA LD 3 and as follows:

Colors, Patterns and Finishes: As indicated or, if not otherwise indicated, as selected by ARCHitect from laminate manufacturer's standard products in the following categories:

Solid colors.

Laminate Grade for Exposed Surfaces: Provide laminate Cladding complying with the following requirements for type of surface and grade.

Horizontal Surfaces Other Than Tops: GP-50 (0.050" nominal thickness).

Vertical Surfaces: GP-28 (0.028" nominal thickness).

Semi-Exposed Surfaces: Woodwork manufacturer's standard low pressure laminate.

Door and Drawer Edges: Manufacturer's standard flat vinyl leatherette finish, T-bumper moulding.

2.4 CABINET HARDWARE AND ACCESSORY MATERIALS

2.4.1 General

Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Division-8 section "Finish Hardware".

2.4.2 Cabinet Hardware Schedule

Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.

2.4.3 Hardware Standard

Comply with ANSI A156.9 and BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by referenced to BHMA numbers or referenced to this standard.

2.4.4 Hardware Finishes

Comply with BHMA 1301 for finishes indicated by BHMA Code Numbers or if not otherwise indicated, provide finishes complying with requirements indicated below:

Clear Tempered Float Glass for Doors: FS DD-G-451, grade B, style I, type, I, quality q3, class 1; manufactured by horizontal (roller hearth) process; 1/4" thick, unless otherwise indicated.

2.5 ARCHITECTURAL CABINET TOPS

2.5.1 Quality Standard

Comply with AWI 400C.

2.5.2 High Pressure Decorative Laminate

Laminator Cladding for Horizontal Surface: High pressure decorative laminate complying with NEMA LD 3 and as follows:

Colors, Patterns, and Finishes: As indicated or, if not otherwise indicated, as selected from laminate manufacturer's standard products in the following categories:

Solid colors.

Grade: GP-50 (0.050" nominal thickness).

Edge Treatment: Same as laminate cladding on horizontal surfaces.

2.6 FASTENERS AND ANCHORS

2.6.1 Screws

Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements. For metal framing supports, provide screws as recommended by metal framing manufacturer.

2.6.2 Nails

Select material, type, size and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

Provide stainless steel or aluminum nails for exposed exterior woodwork which is to receive transparent finish (if any). Provide any type of non-corrosive nail for other exterior woodwork.

2.6.3 Anchors

Select material, type, size and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 EXECUTION

3.1 PREPARATION

Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.

Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

Quality Standard: Install woodwork to comply with AWI 1700 for same grade specified for the type of woodwork involved.

Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk,

concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

3.3 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION

Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair replace woodwork. Adjust joinery for uniform appearance.

Clean, lubricate and adjust hardware.

Clean woodwork on exposed and semi-exposed surfaces.

Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

HARDWARE SCHEDULE:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering hardware which may be incorporated in the work include, but are not limited to, the following:

| | |
|-----|-------------------------------|
| BA | Balwin Hardware Mfg. Corp. |
| BO | Bommer Spring Hinge Co., Inc. |
| GA | Garcy Corporation |
| GR | Grant Pully & Hardware Co. |
| GRA | Grass America |
| HA | Hager Hinge Co. |
| IVS | The H.B. Ives Co. |
| KV | Knape and Vogt |
| McK | McKinney Sales Co. |
| NA | National Lock Co. |
| ST | Stanley Hardware |

Finish shall be US 26 (Bright Chrome) on exposed parts.

Hinges: Stanley 332 for 3/4" thick doors.

Pulls: Stanley 4477

Drawer Slides: KV1300

Door and Drawer Locks: National C8052-14A

Standards: KV255 Brackets: KV256

Door Catches: Stanley 41

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13121

METAL BUILDING SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL
 - 1.2.1 Building Configurations
 - 1.2.2 Manufacturer
 - 1.2.3 Installer
- 1.3 DESIGN REQUIREMENTS
 - 1.3.1 Framing and Structural Members
 - 1.3.2 Roofing and Siding
 - 1.3.3 Gutters And Downspouts
 - 1.3.4 Louvers
- 1.4 SUBMITTALS
- 1.5 DELIVERY AND STORAGE
- 1.6 WARRANTIES
 - 1.6.1 Prime Contractor's Weathertightness Warranty
 - 1.6.2 Manufacturer's Material Warranties
- 1.7 PRE-SUBMITTAL/PRE-APPROVAL COORDINATION MEETING

PART 2 PRODUCTS

- 2.1 FRAMING AND STRUCTURAL MEMBERS
- 2.2 ROOFING AND SIDING
 - 2.2.1 Roofing
 - 2.2.2 Siding
 - 2.2.3 Steel Panels
 - 2.2.4 Aluminum Panels
 - 2.2.5 Factory Insulated Panels
 - 2.2.6 FACTORY COLOR FINISH
 - 2.2.7 Accessories
- 2.3 FASTENERS
- 2.4 DOORS
 - 2.4.1 Sliding Doors
- 2.5 INSULATION
- 2.6 SEALANT
- 2.7 GASKETS AND INSULATING COMPOUNDS
- 2.8 SHOP PRIMING

PART 3 EXECUTION

- 3.1 ERECTION
 - 3.1.1 General
 - 3.1.2 Framing and Structural Members
 - 3.1.3 Roofing and Siding
 - 3.1.4 Doors
 - 3.1.5 Insulation Installation

3.1.5.1 Blanket Insulation
3.2 FIELD PAINTING

-- End of Section Table of Contents --

SECTION 13121

METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA SAS-30 (1986) Aluminum Construction Manual Series
Section 1 Specifications for Aluminum
Structures.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC-S335 (1989) Specification for Structural Steel
Buildings - Allowable Stress Design and
Plastic Design

AISC-S342L (1993) Load and Resistance Factor Design
Specification for Structural Steel
Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI-SG-673 (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1996) Carbon Structural Steel

ASTM A 53 (1996) Pipe, Steel, Black and Hot-Dipped,
Zinc-Coated, Welded and Seamless

ASTM A 252 (1993) Welded and Seamless Steel Pipe Piles

ASTM A 463 (1996a) Steel Sheet, Aluminum-Coated, by
the Hot-Dip Process

ASTM A 500 (1993) Cold-Formed Welded and Seamless
Carbon Steel Structural Tubing in Rounds
and Shapes

ASTM A 501 (1993) Hot-Formed Welded and Seamless
Carbon Steel Structural Tubing

ASTM A 529 (1994) High-Strength Carbon-Manganese
Steel of Structural Quality

| | |
|-------------|---|
| ASTM A 570 | (1996) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality |
| ASTM A 572 | (1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel |
| ASTM A 588 | (1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick |
| ASTM A 606 | (1996) Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance |
| ASTM A 607 | (1996) Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled |
| ASTM A 618 | (1993; R 1995) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing |
| ASTM A 653 | (1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A 792 | (1996) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process |
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B 221 | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| ASTM B 241 | (1996) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube |
| ASTM B 308 | (1996) Aluminum-Alloy 6061-T6 Standard Structural Profiles |
| ASTM B 429 | (1995) Aluminum-Alloy Extruded Structural Pipe and Tube |
| ASTM C 518 | (1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| ASTM D 2244 | (1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates |
| ASTM D 4214 | (1989) Evaluating the Degree of Chalking of Exterior Paint Films |
| ASTM E 84 | (1996a) Surface Burning Characteristics of |

Building Materials

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1996) Structural Welding Code - Steel

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA (1996) Low Rise Building Systems Manual

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA-1013 (1993) Architectural Sheet Metal Manual

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Sep 1997) Tests for Uplift
Resistance of Roof Assemblies

1.2 GENERAL

The metal building system covered under this specification shall be provided by a single manufacturer and shall include all component and assemblies that form a building. Structural Standing Seam Metal Roofing System, when specified, shall be furnished as part of a single manufacturer's system.

1.2.1 Building Configurations

Roof slope shall be as shown on the drawings. Buildings shall be single-span structures with one of the following framing systems: self-framing or rigid frame. Sliding doors and louvers shall be included in the metal building system. Building shall be a manufacturer's advertised product except that dimension shall be not less than those indicated. The minimum inside clear dimensions shall be as shown on the drawings.

1.2.2 Manufacturer

Metal building shall be the product of a recognized steel building systems manufacturer who has been in the practice of manufacturing steel building systems for a period of no less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and fabricating steel building systems.

1.2.3 Installer

Erector shall have specialized experience in the erection of steel building systems for a period of at least 3 years. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural framing against loads, such as wind loads, acting on the exposed framing and seismic forces, as well as loads due to erection equipment and erection operation. Do not field cut or alter structural members. After erection, prime welds, abrasions, and surfaces not shop primed.

1.3 DESIGN REQUIREMENTS

Criteria, loads, loading combinations, and definitions shall be in accordance with MBMA.

1.3.1 Framing and Structural Members

Structural steel members and their connections shall be designed in accordance with AISC-S335 or AISC-S342L. Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI-SG-673. Aluminum structural members and their connections shall be designed in accordance with AA SAS-30. Framed openings shall be designed to structurally replace the covering and framing displaced.

1.3.2 Roofing and Siding

Steel or aluminum roofing and siding shall be designed in accordance with MBMA.

1.3.3 Gutters And Downspouts

Gutters and downspouts shall be designed according to the requirements of SMACNA-1013 for storms which should be exceeded only once in 5 years, with adequate provisions for thermal expansion and contraction.

1.3.4 Louvers

Louvers shall be fixed-blade or adjustable type as designated on drawings to be rainproof.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Instruction Manuals; GA

Manufacturer's literature for individual building component systems.

SD-04 Drawings

Metal Building Systems; GA

Detail drawings consisting of catalog cuts, design and erection drawings.

SD-08 Statements

Qualifications; GA.

Qualifications of the manufacturer, and qualification and experience of the building erector. A brief list of locations where buildings of similar design have been used shall be included with the detail drawings and shall also include information regarding date of completion, name and address of owner, and how the structure is used.

SD-13 Certificates

Metal Building Systems; GA.

- a. A Certificate from the metal building manufacturer stating that the metal building was designed in accordance with MBMA.
- b. Mill certification for structural bolts, framing steel, roofing and siding, and steel wall liner panels.
- c. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Metal Building Roof System, a sample copy of which is attached to this section, the 20-year Manufacturer's Material Warranties, and the Manufacturer's 20-year System Weather tightness Warranty.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials other than framing and structural members shall be covered with weathertight coverings and kept dry. Storage accommodations for roof and wall covering shall provide good air circulation and protection from surface staining.

1.6 WARRANTIES

The Metal Building System (roofing, siding, and related components provided as part of the system) shall be warranted as described below against material and workmanship deficiencies, system deterioration caused by ordinary exposure to the elements and service design loads, leaks and wind uplift damage. Any emergency temporary repairs conducted by the owner shall not negate the warrantees.

1.6.1 Prime Contractor's Weathertightness Warranty

The Metal Building System shall be warranted by the Contractor on a no penal sum basis for a period of five years against materials and workmanship deficiencies; system deterioration caused by ordinary exposure to the elements and service design loads, water leaks, and wind uplift damage. The Metal Building System covered under this warranty shall include but is not limited to the following: framing and structural members, roofing and siding panels and seams, interior or exterior gutters and downspouts, accessories, fasteners, trim, flashings and miscellaneous building closure items such as doors and windows (when furnished by the manufacturer), connectors, components, and fasteners, and other system components and assemblies installed to provide a weathertight system; and items specified in other sections of these specifications that become part of the metal building system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's written warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and/or system manufacturer responsible for this warranty. The Contractor's written warranty shall be as outlined in attach **WARRANTY FOR METAL BUILDING SYSTEMS**, and start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total metal building system cost in favor of the

owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire metal building system as outlined above.

1.6.2 Manufacturer's Material Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties to the Contracting Officer which cover all Metal Building System components:

- a. A manufacturer's twenty year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, rupture, perforated, or structurally failed securement system including fasteners and coil material.
- b. A manufacturer's twenty year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color(s) in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to replacing the defective coated material.

1.7 PRE-SUBMITTAL/PRE-APPROVAL COORDINATION MEETING

A coordination meeting shall be held within 45 days after contract award for mutual understanding of the metal building system contract requirements. This meeting shall take place at the building system manufacturer's home office and shall include representatives from the Contractor, the SSSMR supplier, the erector, the manufacturer, the designer, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 FRAMING AND STRUCTURAL MEMBERS

Steel 1/8 inch or more in thickness shall conform to ASTM A 36, ASTM A 529, ASTM A 572, or ASTM A 588. Uncoated steel less than 1/8 inch in thickness shall conform to ASTM A 570, ASTM A 606, or ASTM A 607. Galvanized steel shall conform to ASTM A 653, G 90 coating designation, 0.045 inch minimum thickness. Aluminum-zinc coated steel shall conform to ASTM A 792, AZ 55 coating designation, 0.045 inch minimum thickness. Aluminum sheet shall conform to ASTM B 209, 0.032 inch minimum thickness. Aluminum structural shapes and tubes shall conform to ASTM B 221, or ASTM B 308. Structural pipe shall conform to ASTM A 53, ASTM A 252, ASTM A 500, ASTM A 501, ASTM A 618, ASTM B 221, ASTM B 241 or ASTM B 429. Holes for bolts shall be made in the shop.

2.2 ROOFING AND SIDING

Roofing shall be either steel or aluminum and shall have a factory color finish.

2.2.1 Roofing

Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope unless otherwise approved. Width of sheets with overlapping configurations shall provide not less than 24 inches of coverage in place, and those with interlocking ribs shall provide not less than 12 inches of coverage in place. Panel shall have configurations for overlapping sheets. Roof deck assemblies shall be Class 90 as defined in UL 580. Height of corrugation at overlap of adjacent roof sheets shall be the building manufacturer's standard.

2.2.2 Siding

Length of sheets shall be sufficient to cover the entire length of any unbroken height of wall surface unless otherwise approved. Width of sheets with overlapping configurations shall provide not less than 24 inches of coverage in place. Siding shall have configurations for overlapping sheets. Siding shall be fastened to framework using exposed or concealed fasteners.

2.2.3 Steel Panels

Roofing and Siding shall be zinc-coated steel conforming to ASTM A 653, G 90 coating designation; aluminum-zinc alloy coated steel conforming to ASTM A 792, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 E5. Panels shall be 0.024 inch thick minimum.

2.2.4 Aluminum Panels

Roofing and Siding shall be aluminum alloy conforming to ASTM B 209, temper as required for the forming operation, minimum 0.032 inch thick.

2.2.5 Factory Insulated Panels

Insulated wall units shall be factory-fabricated units with insulating core between metal face sheets, securely fastened together and uniformly separated with rigid spacers, facing of steel or aluminum of composition and gauge specified for covering, constructed in a manner that will eliminate condensation on interior of panel. Panels shall have a factory color finish. Insulation shall be compatible with adjoining materials; nonrunning and nonsettling; capable of retaining its R-value for the life of the metal facing sheets; and unaffected by extremes of temperature and humidity. The assembly shall have a flame spread rating not higher than 25, and smoke developed rating not higher than 450 when tested in accordance with ASTM E 84. The insulation shall remain odorless, free from mold, and not become a source of food and shelter for insects. Panels shall be not less than 8 inches wide and shall be in one piece for unbroken wall heights.

2.2.6 FACTORY COLOR FINISH

Wall and roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on fluoropolymer enamel topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior

coating shall be a nominal 2 mil thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 1.0 mil thickness. The interior color finish shall consist of the same coating and dry film thickness as the exterior. The exterior color finish shall meet the test requirements specified below.

2.2.7 Accessories

Flashing, trim, metal closure strips and curbs, fascia, caps, diverters, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the building finish. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the roofing or siding and shall not absorb or retain water.

2.3 FASTENERS

Fasteners shall be as recommended by the manufacturer to meet the design strength requirements.

2.4 DOORS

2.4.1 Sliding Doors

Sliding doors shall be of the metal framed or self-framing metal type. Covering shall be of same material and finish as the siding, except heavier gauge material shall be used if required to provide rigidity. All hardware necessary for the complete installation of the doors shall be furnished. Accessories shall include galvanized steel track, brackets, permanently lubricated dual wheel trolley hangers, operating handle, slide bolt latch assembly permitting padlocking from either inside or outside of building and rubber or elastomeric weatherstripping.

2.5 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 75 degrees F in accordance with ASTM C 518. Roof and wall insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Insulation including facings shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 450 when tested in accordance with ASTM E 84.

2.6 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency.

2.7 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.8 SHOP PRIMING

Ferrous surfaces shall be cleaned of oil, grease, loose rust, loose mill scale, and other foreign substances and shop primed. Primer coating shall be in accordance with the manufacturer's standard system.

PART 3 EXECUTION

3.1 ERECTION

3.1.1 General

Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces shall be kept clean and free from sealant, metal cuttings, excess material from thermal cutting, and other foreign materials. Exposed surfaces which have been thermally cut shall be finished smooth within a tolerance of 1/8 inch. Stained, discolored or damaged sheets shall be removed from the site. Welding of steel shall conform to AWS D1.1; welding of aluminum shall conform to AA SAS-30.

3.1.2 Framing and Structural Members

On-site flame cutting of framing members, with the exception of small access holes in structural beam or column webs, shall not be permitted. Concrete work is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Anchor bolts shall be accurately set by template while the concrete is in a plastic state. Members shall be accurately spaced to assure proper fitting of panels. As erection progresses, the work shall be securely fastened to resist the dead load and wind and erection stresses.

3.1.3 Roofing and Siding

Siding shall be applied with the longitudinal configurations in the vertical position. Roofing shall be applied with the longitudinal configurations in the direction of the roof slope. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction. Fastener and fastener spacing shall be in accordance with manufacture design.

3.1.4 Doors

Doors including frames and hardware, shall be securely anchored to the supporting construction, shall be installed plumb and true, and shall be adjusted as necessary to provide proper operation. Joints at doors shall be sealed according to manufacturer's recommendations to provide weathertight construction.

3.1.5 Insulation Installation

Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.1.5.1 Blanket Insulation

Blanket insulation shall be installed over the purlins and held tight

against the metal roofing. It shall be supported by an integral facing or other commercially available support system.

3.2 FIELD PAINTING

Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Shop-primed ferrous surfaces exposed on the outside of the building and all shop-primed surfaces of doors shall be painted with two coats of an approved exterior enamel. Factory color finished surfaces shall be touched up as necessary with the manufacturer's recommended touch-up paint.

**CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM**

FACILITY DESCRIPTION: _____

BUILDING NUMBER: _____

CORPS OF ENGINEERS CONTRACT NUMBER: _____

CONTRACTOR

CONTRACTOR: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION AGENT: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(continued)

THE METAL BUILDING SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE AND STRUCTURAL FAILURE WITHIN PROJECT SPECIFIED DESIGN LOADS, AND LEAKAGE. THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING: FRAMING AND STRUCTURAL MEMBERS, ROOFING AND SIDING PANELS AND SEAMS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, ACCESSORIES, TRIM, FLASHINGS AND MISCELLANEOUS BUILDING CLOSURE ITEMS SUCH AS DOORS AND WINDOWS (WHEN FURNISHED BY THE MANUFACTURER), CONNECTORS, COMPONENTS, AND FASTENERS, AND OTHER SYSTEM COMPONENTS AND ASSEMBLIES INSTALLED TO PROVIDE A WEATHERTIGHT SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS THAT BECOME PART OF THE METAL BUILDING SYSTEM. ALL MATERIAL AND WORKMANSHIP DEFICIENCIES, SYSTEM DETERIORATION CAUSED BY EXPOSURE TO THE ELEMENTS AND/OR INADEQUATE RESISTANCE TO SPECIFIED SERVICE DESIGN LOADS, WATER LEAKS AND WIND UPLIFT DAMAGE SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE AND LEAKAGE ASSOCIATED WITH THE METAL BUILDING SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE METAL BUILDING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE BUILDING SYSTEM DUE TO ACTIONS BY THE OWNER. INHIBIT FREE DRAINAGE FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR CONDITIONS WHICH CREATE PONDING WATER ON THE ROOF OR AGAINST THE BUILDING SIDING.
6. THIS WARRANTY APPLIES TO THE METAL BUILDING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

REPORTS OF LEAKS AND BUILDING SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING FROM EITHER THE OWNER, OR CONTRACTING OFFICER. EMERGENCY REPAIRS, TO PREVENT FURTHER ROOF LEAKS, SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE METAL BUILDING SYSTEM REPAIRED OR REPAIRED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR. IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT HE MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION, UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
METAL BUILDING SYSTEM
(Exclusions from Coverage Continued)

NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED THE PARTIES SHALL, WITHIN 10 DAYS JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN 10 DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15250

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 GENERAL QUALITY CONTROL
 - 1.3.1 Standard Products
 - 1.3.2 Installer's Qualifications
 - 1.3.3 Surface Burning Characteristics
 - 1.3.4 Identification of Materials
- 1.4 SUBMITTALS
- 1.5 STORAGE

PART 2 PRODUCTS

- 2.1 GENERAL MATERIALS
 - 2.1.1 Adhesives
 - 2.1.1.1 Acoustical Lining Insulation Adhesive
 - 2.1.1.2 Mineral Fiber Insulation Cement
 - 2.1.1.3 Lagging Adhesive
 - 2.1.2 Contact Adhesive
 - 2.1.3 Caulking
 - 2.1.4 Corner Angles
 - 2.1.5 Finishing Cement
 - 2.1.6 Fibrous Glass Cloth and Glass Tape
 - 2.1.7 Staples
 - 2.1.8 Jackets
 - 2.1.8.1 White Vapor Retarder ASJ (All Service Jacket)
 - 2.1.8.2 Aluminum Jackets
 - 2.1.8.3 Polyvinyl Chloride (PVC) Jackets
 - 2.1.9 Vapor Retarder Coating
 - 2.1.10 Wire
- 2.2 PIPE INSULATION MATERIALS
 - 2.2.1 Aboveground Cold Pipeline
 - 2.2.1.1 Cellular Glass
 - 2.2.1.2 Flexible Cellular Insulation
 - 2.2.1.3 Phenolic Insulation
 - 2.2.2 Aboveground Hot Pipeline
 - 2.2.2.1 Mineral Fiber
 - 2.2.2.2 Cellular Glass
 - 2.2.2.3 Flexible Cellular Insulation
 - 2.2.2.4 Phenolic Insulation
- 2.3 DUCT INSULATION MATERIALS
 - 2.3.1 Rigid Mineral Fiber
 - 2.3.2 Flexible Mineral Fiber
 - 2.3.3 Flexible Cellular

PART 3 EXECUTION

- 3.1 APPLICATION - GENERAL
 - 3.1.1 Installation
 - 3.1.2 Painting and Finishing
 - 3.1.3 Flexible Cellular Insulation
 - 3.1.4 Welding
 - 3.1.5 Pipes/Ducts which Require Insulation
- 3.2 PIPE INSULATION INSTALLATION
 - 3.2.1 Pipe Insulation
 - 3.2.1.1 General
 - 3.2.1.2 Pipes Passing Through Sleeves
 - 3.2.1.3 Pipes Passing Through Hangers
 - 3.2.1.4 Pipes Passing Through Walls
 - 3.2.1.5 Flexible Cellular Pipe Insulation
 - 3.2.2 Aboveground Cold Pipelines
 - 3.2.2.1 Insulation Thickness
 - 3.2.2.2 Jacket for Fibrous, Cellular Glass, and Phenolic Foam Insulated Pipe
 - 3.2.2.3 Insulation for Straight Runs (Fibrous, Cellular Glass and Phenolic Foam)
 - 3.2.2.4 Insulation for Fittings and Accessories
 - 3.2.2.5 Optional PVC Fitting Covers
 - 3.2.3 Aboveground Hot Pipelines
 - 3.2.3.1 Insulation Thickness
 - 3.2.3.2 Jacket for Insulated Pipe
 - 3.2.3.3 Insulation for Straight Runs
 - 3.2.3.4 Insulation for Fittings and Accessories
- 3.3 DUCT INSULATION INSTALLATION
 - 3.3.1 Duct Insulation Thickness
 - 3.3.2 Insulation for Warm Air Duct
 - 3.3.2.1 Installation on Concealed Duct
 - 3.3.2.2 Installation on Exposed Duct
 - 3.3.3 Duct Test Holes

-- End of Section Table of Contents --

SECTION 15250
THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. At the discretion of the government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|------------|---|
| ASTM A 167 | (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| ASTM A 580 | (1995a) Stainless and Heat-Resisting Steel Wire |
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM C 195 | (1990) Mineral Fiber Thermal Insulating Cement |
| ASTM C 449 | (1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement |
| ASTM C 534 | (1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form |
| ASTM C 547 | (1995) Mineral Fiber Pipe Insulation |
| ASTM C 552 | (1991) Cellular Glass Thermal Insulation |
| ASTM C 553 | (1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications |
| ASTM C 612 | (1993) Mineral Fiber Block and Board Thermal Insulation |
| ASTM C 647 | (1995) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation |
| ASTM C 795 | (1992) Thermal Insulation for Use in Contact With Austenitic Stainless Steel |
| ASTM C 871 | (1995) Test Methods for Chemical Analysis |

| | |
|-------------|--|
| | of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions |
| ASTM C 916 | (1985; Rev 1990) Adhesives for Duct Thermal Insulation |
| ASTM C 920 | (1994) Elastomeric Joint Sealants |
| ASTM C 921 | (1989 R; 1996) Determining the Properties of Jacketing Materials for Thermal Insulation |
| ASTM C 1126 | (1989; R 1994) Specification for faced or Unfaced Rigid Cellular Phenolic Thermal Insulation |
| ASTM D 3278 | (1989) Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus |
| ASTM E 84 | (1996a) Surface Burning Characteristics of Building Materials |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

| | |
|-----------|--|
| MSS SP-69 | (1996) Pipe Hangers and Supports - Selection and Application |
|-----------|--|

1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are

located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by ASTM E 84.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-14 Samples

Thermal Insulation Materials; GA.

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants by the Contractor. Insulation material and supplies that become dirty, dusty, wet, or otherwise contaminated may be rejected by the Contracting Officer.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

2.1.1 Adhesives

2.1.1.1 Acoustical Lining Insulation Adhesive

Insulation shall be applied in cut-to-size pieces attached to the interior of the duct with a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I. Exposed edges of the liner at the duct ends and at other

joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire-resistant adhesive to prevent delamination of glass fibers.

2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.1.1.3 Lagging Adhesive

Lagging adhesives shall be nonflammable and fire-resistant and shall have flame spread and smoke developed ratings of 25/50 when measured in accordance with ASTM E 84. Adhesives shall be either the Class 1 or Class 2 type as defined here. Class 1 adhesive shall be pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation. Class 2 adhesive shall be pigmented white and be suitable for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesive may be dispersed in a nonhalogenated organic solvent with a low flash point (flash point less than minus 25 degrees F when tested in accordance with ASTM D 3278) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 200 degrees F. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not omit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The adhesive shall be nonflammable and fire resistant.

2.1.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.016 inch aluminum 1 x 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

Mineral fiber hydraulic-setting thermal insulating cement ASTM C 449.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with ASTM E 84. Fibrous glass cloth and tape; 20 x 20 maximum size mesh. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces per square yard.

2.1.7 Staples

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel.

2.1.8 Jackets

ASTM C 921, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pound/inch width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pound/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.1 White Vapor Retarder ASJ (All Service Jacket)

For use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch diameter. Aluminum jacket circumferential seam bands shall be 2 x 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 x 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch. Insulation under PVC jacket shall meet jacket manufacturer's written recommendations.

2.1.9 Vapor Retarder Coating

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to procedure B of ASTM E 96 utilizing apparatus described in ASTM E 96. The coating shall be a nonflammable, fire resistant type. The flash point of the compound shall not be less than 80 degrees F and shall be determined in accordance with ASTM D 3278. All other application and service properties shall be in accordance with ASTM C 647.

2.1.10 Wire

Soft annealed ASTM A 580 Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2 PIPE INSULATION MATERIALS

Pipe insulation materials shall be as follows:

2.2.1 Aboveground Cold Pipeline

Insulation for minus 30 degrees to Plus 60 degrees F shall be as follows:

2.2.1.1 Cellular Glass

ASTM C 552, Type II, and Type III.

2.2.1.2 Flexible Cellular Insulation

ASTM C 534, Type I or II. Type II shall have vapor retarder skin on both sides of the insulation.

2.2.1.3 Phenolic Insulation

ASTM C 1126, Type III. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.2.2 Aboveground Hot Pipeline

For aboveground hot pipeline above 60 degrees F insulation the following requirements shall be met.

2.2.2.1 Mineral Fiber

ASTM C 547, Class 1 or Class 2 as required for the operating temperature range.

2.2.2.2 Cellular Glass

ASTM C 552, Type II and Type III.

2.2.2.3 Flexible Cellular Insulation

ASTM C 534, Type I or II to 200 degrees F service.

2.2.2.4 Phenolic Insulation

ASTM C 1126 Type III to 250 F service. A maximum allowable leachable chloride content shall comply with ASTM C 795 when tested in accordance with ASTM C 871.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be as follows:

2.3.1 Rigid Mineral Fiber

ASTM C 612, Class 1.

2.3.2 Flexible Mineral Fiber

ASTM C 553, Type I, Class B-2.

2.3.3 Flexible Cellular

ASTM C 534 Type II.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the drawings.

3.1.2 Painting and Finishing

Painting shall be as specified in Section 09900 PAINTING, GENERAL.

3.1.3 Flexible Cellular Insulation

Flexible cellular insulation shall be installed with seams and joints sealed with a contact adhesive. Flexible cellular insulation shall not be used on surfaces greater than 200 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish as recommended by the manufacturer after the adhesive is dry.

3.1.4 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.5 Pipes/Ducts which Require Insulation

Insulation is required, unless stated otherwise, on all pipes or ducts, which operate at or below 60 F and at or above 80 F.

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Unions in pipe above 60 degrees F.

3.2.1.2 Pipes Passing Through Sleeves

- a. Pipe insulation shall be continuous through the sleeve.
- b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.
- c. Where penetrating interior walls, the aluminum jacket shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.
- d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.
- e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.
- f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.
- g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulations for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.
- h. In high abuse areas such as traffic areas in equipment rooms, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 5 ft level shall be protected.

3.2.1.3 Pipes Passing Through Hangers

- a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall

be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed.

- b. Horizontal pipes larger than 2 inches below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass or calcium silicate shall be installed above each shield. The insert shall cover not less than the bottom 180 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.
- d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360 degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe which are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.
- e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to ASTM C 921, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Pipes Passing Through Walls

- a. For hot water pipes supplying lavatories or other similar heated service which requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with

glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. Caulk the annular space between the pipe and wall penetration. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inch.

- b. For domestic cold water pipes requiring insulation, the insulation shall be terminated on the finished side of the wall (i.e. insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Caulk the annular space between the pipe and wall penetration. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inch.

3.2.1.5 Flexible Cellular Pipe Insulation

Flexible cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.2 Aboveground Cold Pipelines

The following shall be included for aboveground cold pipelines minus 30 degrees to plus 60 degrees F:

- a. Domestic cold water.

3.2.2.1 Insulation Thickness

Insulation thickness for cold pipelines shall be determined using Table I.

Table I - Cold Piping Insulation Thickness
Pipe Size (inches)

| Type of Service | Material | Runouts up to 2 in* | 1 in & less | 1.25 - 2 in | 2.5 - 4 in | 5 - 6 in | 8 in & larger |
|--|----------|---------------------|-------------|-------------|------------|----------|---------------|
| Cold domestic water, above and below ceilings | CG | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| | FC | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 |
| | PF | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 |
| Exposed lavatory drains exposed domestic water piping & drains to areas for handicap | FC | 0.5 | 0.5 | 0.5 | 0.5 | 3/4 | 3/4 |
| | MF | 0.5 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 |

Table I - Cold Piping Insulation Thickness
Pipe Size (inches)

| Type of Service | Material | Runouts up to 2 in* | 1 in & less | 1.25 - 2 in | 2.5 - 4 in | 5 - 6 in | 8 in & larger |
|-----------------|----------|---------------------|-------------|-------------|------------|----------|---------------|
| personnel | | | | | | | |

*When runouts to terminal units exceed 12 feet, the entire length of runout shall be insulated like main feed pipe.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
MF - Mineral Fiber
FC - Flexible Cellular

3.2.2.2 Jacket for Fibrous, Cellular Glass, and Phenolic Foam Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building shown to be protected with an aluminum jacket shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as traffic areas in equipment rooms, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 5 ft level will be protected.

3.2.2.3 Insulation for Straight Runs (Fibrous, Cellular Glass and Phenolic Foam)

- a. Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor retarder coating at intervals not to exceed 15 feet.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating.
- f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing

it with adhesive, stapling, and coating with vapor retarder coating. The patch shall extend not less than 1-1/2 inches past the break.

- g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating.

3.2.2.4 Insulation for Fittings and Accessories

- a. Pipe insulation shall have ends thoroughly coated with a vapor retarder coating not less than 6 inches from each flange, union, valve, anchor, or fitting in all directions.
- b. Precut, preformed insulation for placement over fittings, flanges, unions, valves, anchors, and mechanical couplings shall be used. Precut, preformed insulation shall exhibit the same properties as the adjoining pipe insulation. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation should be overlapped 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Elbows insulated using segments shall not have less than 3 segments per elbow.
- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches.
- d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.
- e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same thickness as adjoining pipe insulation and the insulation shall be protected with one coat of vapor retarder coating under the PVC cover. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

For hot pipelines above 60 degrees F the following shall be included:

- a. Domestic hot water.

3.2.3.1 Insulation Thickness

Insulation thickness for hot pipelines shall be determined using Table II.

LEGEND:

PF - Phenolic Foam
 CG - Cellular Glass
 MF - Mineral Fiber
 FC - Flexible Cellular

Table II - Hot Piping Insulation Thickness
 Pipe Size (inches)

| Type of Service (degrees F) | Material | Runouts up to 2 in | 1 in & less | 1.25 - 2 in | 2.5 - 4 in | 5 - 6 in | 8 in & larger |
|--|----------|--------------------------|-------------------|-------------------|------------------|----------------|---------------------|
| Hot domestic water supply & recirculating system (200 F max) | CG | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| | FC | 0.5 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 |
| | PF | 0.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| | MF | 0.5 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 |

*When runouts to terminal units exceed 12 feet, the entire length of runout shall be insulated like the main feed pipe.

3.2.3.2 Jacket for Insulated Pipe

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

- Insulation shall be applied to the pipe with joints tightly butted.
- Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches, and butt strips 3 inches wide shall be provided for circumferential joints.
- Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.
- Factory self-sealing lap systems may be used when the ambient temperature is between 40 degrees and 120 degrees F and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is nonadhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and be secured with adhesive and stapled on 4 inch centers if not factory

self-sealing. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 1-1/2 inches past the break.

- f. Install flexible cellular pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used. Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.3.4 Insulation for Fittings and Accessories

- a. The run of the line pipe insulation shall have the ends brought up to the item.
- b. Insulation of the same thickness and conductivity as the adjoining pipe insulation, either premolded or segmented, shall be placed around the item abutting the adjoining pipe insulation, or if nesting size insulation is used, overlapping 2 inches or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 3 inch size shall be premolded. Insulation for elbows 3 inch size and larger shall be either premolded or segmented. Elbows insulated using segments shall have not less than 3 segments per elbow. Insulation may be wired or taped on until finish is applied.
- c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of Class 1 adhesive applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. Adhesive shall extend onto the adjoining insulation not less than 2 inches. The total dry film thickness shall be not less than 1/16 inch.
- d. Insulation terminations shall be tapered to unions at a 45-degree angle.
- e. At the option of the Contractor, factory premolded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory premolded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers.

3.3 DUCT INSULATION INSTALLATION

Corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III.

Table III - Minimum Duct Insulation (inches)

| | |
|------------------------|-----|
| Warm Air Ducts | 2.0 |
| Relief Ducts | 1.5 |
| Fresh Air Intake Ducts | 1.5 |

3.3.2 Insulation for Warm Air Duct

For warm air ducts above 60 degrees F, ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

- a. Supply ducts.
- c. Relief air ducts.
- i. Fresh air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf; and rigid type where exposed, minimum density 3 pcf. Insulation on exposed ducts shall be provided with a white, paintable, factory-applied Type II jacket, or finished with Class 1 adhesive finish. Flexible type insulation shall be used for round ducts, minimum density 3/4 pcf with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Class 1 adhesive finish where indicated to be used shall be accomplished by applying two coats of Class 1 adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.2.1 Installation on Concealed Duct

- a. For rectangular, oval and round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.
- d. The insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and

trapeze-type hangers.

- e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.
- f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured with Class 2 adhesive under the lap and stapled on 4 inch centers.

3.3.2.2 Installation on Exposed Duct

- a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.
- b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin excess clipped and bent over.
- d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of the same material as the jacket. The strip shall be secured with Class 2 adhesive and stapled.
- e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with Class 2 adhesive and stapled.
- f. Insulation terminations and pin punctures shall be sealed and flashed with a Class 1 adhesive. Two coats of Class 1 adhesive coating shall be applied with glass cloth embedded between coats. The total coating shall have a dry film thickness of approximately 1/16 inch and shall overlap the adjoining insulation and uninsulated surface 2 inches.
- g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by applying Class 2 adhesive around the entire perimeter of the duct in 6 inch wide stripe on 12 inch center. Joints shall be sealed with a 4 inch wide strip of the same material as the jacket. The strip shall be secured with Class 2 adhesive and stapled.

3.3.3 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 STANDARD PRODUCTS
- 1.3 PERFORMANCE REQUIREMENTS
 - 1.3.1 Welding
- 1.4 SUBMITTALS
- 1.5 REGULATORY REQUIREMENTS
 - 1.5.1 Plumbing
- 1.6 PROJECT/SITE CONDITIONS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Pipe Joint Materials
 - 2.1.2 Miscellaneous Materials
 - 2.1.3 Pipe Insulation Material
- 2.2 PIPE HANGERS, INSERTS, AND SUPPORTS
- 2.3 VALVES
 - 2.3.1 Backwater Valves
 - 2.3.2 Wall Faucets (Hose Bibb)
 - 2.3.3 Relief Valves
- 2.4 FIXTURES
 - 2.4.1 Lavatories
- 2.5 BACKFLOW PREVENTERS
- 2.6 DRAINS
 - 2.6.1 Floor and Shower Drains
 - 2.6.1.1 Metallic Shower Pan Drains
 - 2.6.1.2 Drains and Backwater Valves
- 2.7 SHOWER PAN
 - 2.7.1 Sheet Copper
 - 2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material
 - 2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material
- 2.8 TRAPS
- 2.9 WATER HEATER
 - 2.9.1 Automatic Storage Type
 - 2.9.2 Oil-Fired Type
 - 2.9.3 Gas-Fired Type
- 2.10 COMPRESSED AIR SYSTEM
 - 2.10.1 Air Compressors
 - 2.10.2 Air Receivers
 - 2.10.3 Intake Air Supply Filter
 - 2.10.4 Pressure Regulators

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
 - 3.1.1 Water Pipe, Fittings, and Connections
 - 3.1.1.1 Utilities
 - 3.1.1.2 Cutting and Repairing
 - 3.1.1.3 Protection of Fixtures, Materials, and Equipment
 - 3.1.1.4 Mains, Branches, and Runouts
 - 3.1.1.5 Pipe Drains
 - 3.1.1.6 Expansion and Contraction of Piping
 - 3.1.1.7 Commercial-Type Water Hammer Arresters
 - 3.1.2 Compressed Air Piping (Non-Oil Free)
 - 3.1.3 Joints
 - 3.1.3.1 Threaded
 - 3.1.3.2 Union
 - 3.1.3.3 Cast Iron Soil, Waste and Vent Pipe
 - 3.1.3.4 Copper Tube and Pipe
 - 3.1.3.5 Plastic Pipe
 - 3.1.3.6 Corrosive Waste Plastic Pipe
 - 3.1.4 Dissimilar Pipe Materials
 - 3.1.5 Corrosion Protection for Buried Pipe and Fittings
 - 3.1.5.1 Cast Iron and Ductile Iron
 - 3.1.6 Pipe Sleeves and Flashing
 - 3.1.6.1 Sleeve Requirements
 - 3.1.6.2 Flashing Requirements
 - 3.1.6.3 Waterproofing
 - 3.1.6.4 Pipe Penetrations of Slab on Grade Floors
 - 3.1.7 Supports
 - 3.1.7.1 General
 - 3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements
 - 3.1.7.3 Pipe Hangers, Inserts, and Supports
 - 3.1.8 Pipe Cleanouts
- 3.2 WATER HEATERS AND HOT WATER STORAGE TANKS
 - 3.2.1 Relief Valves
 - 3.2.2 Installation of Gas-Fired Water Heater
 - 3.2.3 Heat Traps
 - 3.2.4 Connections to Water Heaters
- 3.3 FIXTURES AND FIXTURE TRIMMINGS
 - 3.3.1 Fixture Connections
 - 3.3.2 Flushometer Valves
 - 3.3.3 Height of Fixture Rims Above Floor
 - 3.3.4 Shower Bath Outfits
 - 3.3.5 Fixture Supports
 - 3.3.5.1 Support for Solid Masonry Construction
 - 3.3.5.2 Support for Cellular-Masonry Wall Construction
 - 3.3.5.3 Support for Steel Stud Frame Partitions
 - 3.3.5.4 Support for Wood Stud Construction
 - 3.3.6 Backflow Prevention Devices
 - 3.3.7 Access Panels
 - 3.3.8 Traps
 - 3.3.9 Shower Pans
 - 3.3.9.1 General
 - 3.3.9.2 Metal Shower Pans
 - 3.3.9.3 Nonplasticized Chlorinated Polyethylene Shower Pans
 - 3.3.9.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans
- 3.4 VIBRATION-ABSORBING FEATURES
 - 3.4.1 Compressors
- 3.5 IDENTIFICATION SYSTEMS
 - 3.5.1 Color Coding
- 3.6 ESCUTCHEONS
- 3.7 PAINTING

- 3.8 TESTS FLUSHING AND STERILIZATION
 - 3.8.1 Plumbing System
 - 3.8.1.1 Test of Backflow Prevention Assemblies
 - 3.8.1.2 Shower Pans
 - 3.8.1.3 Compressed Air Piping (Nonoil-Free)
 - 3.8.2 Defective Work
 - 3.8.3 System Flushing
 - 3.8.4 Operational Test
 - 3.8.5 Disinfection
- 3.9 PLUMBING FIXTURE SCHEDULE
- 3.10 POSTED INSTRUCTIONS
- 3.11 PERFORMANCE OF WATER HEATING EQUIPMENT
 - 3.11.1 Storage Water Heaters
 - 3.11.1.1 Gas

-- End of Section Table of Contents --

SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|---------------|---|
| ANSI Z21.10.1 | (1993; Z21.10.1a; Z21.10.1b; Z21.10.1c) Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less |
| ANSI Z21.10.3 | (1993; Z21.10.3a; Z21.10.3b) Gas Water Heaters Vol. III Storage, With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters |
| ANSI Z21.22 | (1986; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|---|
| ASTM A 53 | (1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| ASTM A 74 | (1996) Cast Iron Soil Pipe and Fittings |
| ASTM A 183 | (1983; R 1990) Carbon Steel Track Bolts and Nuts |
| ASTM A 733 | (1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples |
| ASTM A 888 | (1994) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications |
| ASTM B 32 | (1995b) Solder Metal |
| ASTM B 42 | (1993) Seamless Copper Pipe, Standard Sizes |
| ASTM B 88 | (1996) Seamless Copper Water Tube |
| ASTM B 370 | (1992) Copper Sheet and Strip for Building Construction |
| ASTM B 813 | (1993) Liquid and Paste Fluxes for |

| | |
|-------------|--|
| | Soldering Applications of Copper and Copper Alloy Tube |
| ASTM B 828 | (1992) Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings |
| ASTM C 564 | (1995) Rubber Gaskets for Cast Iron Soil Pipe and Fittings |
| ASTM C 920 | (1994) Elastomeric Joint Sealants |
| ASTM D 638 | (1996) Tensile Properties of Plastics |
| ASTM D 1004 | (1994a) Initial Tear Resistance of Plastic Film and Sheeting |
| ASTM D 1248 | (1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials |
| ASTM D 1785 | (1994) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 |
| ASTM D 2000 | (1996) Rubber Products in Automotive Applications |
| ASTM D 2235 | (1993a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings |
| ASTM D 2241 | (1994) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) |
| ASTM D 2464 | (1994) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D 2466 | (1994a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 |
| ASTM D 2467 | (1994) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D 2564 | (1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems |
| ASTM D 2657 | (1990) Heat-Joining Polyolefin Pipe and Fittings |
| ASTM D 2665 | (1995) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings |
| ASTM D 2672 | (1993; R 1995) Joints for IPS PVC Pipe Using Solvent Cement |
| ASTM D 2822 | (1991) Asphalt Roof Cement |
| ASTM D 2855 | (1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings |

| | |
|-------------|--|
| ASTM D 2996 | (1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe |
| ASTM D 3138 | (1993) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components |
| ASTM D 3139 | (1989; R 1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals |
| ASTM D 3212 | (1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals |
| ASTM D 3308 | (1991a) PTFE Resin Skived Tape |
| ASTM D 3311 | (1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns |
| ASTM D 4551 | (1991) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |
| ASTM F 409 | (1995) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings |
| ASTM F 477 | (1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe |
| ASTM F 493 | (1993a) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings |
| ASTM F 891 | (1993a) Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core |
| ASTM F 1290 | (1993) Electrofusion Joining Polyolefin Pipe and Fittings |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|-----------------|--|
| ASME A112.1.2 | (1991) Air Gaps in Plumbing Systems |
| ASME A112.14.1 | (1975; R 1990) Backwater Valves |
| ASME A112.18.1M | (1996) Plumbing Fixture Fittings |
| ASME A112.19.1M | (1994) Enameled Cast Iron Plumbing Fixtures |
| ASME A112.19.2M | (1995; Errata) Vitreous China Plumbing Fixtures |

| | |
|---------------------|--|
| ASME A112.21.1M | (1991) Floor Drains |
| ASME A112.36.2M | (1991) Cleanouts |
| ASME B1.20.1 | (1983; R 1992) Pipe Threads, General Purpose (Inch) |
| ASME B16.4 | (1992) Gray Iron Threaded Fittings |
| ASME B16.12 | (1991) Cast Iron Threaded Drainage Fittings |
| ASME B16.15 | (1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250 |
| ASME B16.18 | (1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings |
| ASME B16.22 | (1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings |
| ASME B16.24 | (1991; Errata) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500, and Flanged Fittings, Class 150 and 300 |
| ASME B16.39 | (1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300 |
| ASME B31.1 | (1995) Power Piping |
| ASME B31.5 | (1992; B31.5a) Refrigeration Piping |
| ASME BPV VIII Div 1 | (1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage |
| ASME BPV IX | (1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications |

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

| | |
|-----------|--|
| ASSE 1001 | (1990) Pipe Applied Atmospheric Type Vacuum Breakers |
| ASSE 1005 | (1993) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size |
| ASSE 1011 | (1995) Hose Connection Vacuum Breakers |
| ASSE 1012 | (1995) Backflow Preventers with Intermediate Atmospheric Vent |
| ASSE 1013 | (1971; Rev thru Oct 1993) Reduced Pressure Principle Backflow Preventers |
| ASSE 1018 | (1977; Rev Jan 1986) Trap Seal Primer Valves Water Supply Fed |

ASSE 1037 (1986; Rev thru Mar 1990) Pressurized
Flushing Devices (Flushometers) for
Plumbing Fixtures/F

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01 (1995) Standard Methods for the
Examination of Water and Wastewater

AWWA B300 (1992) Hypochlorites

AWWA B301 (1992) Liquid Chlorine

AWWA C105 (1993) Polyethylene Encasement for
Ductile-Iron Pipe Systems

AWWA C203 (1991) Coal-Tar Protective Coatings and
Linings for Steel Water Pipelines - Enamel
and Tape - Hot-Applied

AWWA C606 (1987) Grooved and Shouldered Joints

AWWA M20 (1973) Manual: Water Chlorination
Principles and Practices

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 (1992) Filler Metals for Brazing and Braze
Welding

AWS B2.2 (1991) Brazing Procedure and Performance
Qualification

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301 (1995) Hubless Cast Iron Soil Pipe and
Fittings for Sanitary and Storm Drain,
Waste, and Vent Piping Applications

CISPI HSN-85 (1985) Neoprene Rubber Gaskets for Hub and
Spigot Cast Iron Soil Pipe and Fittings

CODE OF FEDERAL REGULATIONS (CFR)

10 CFR 430 Energy Conservation Program for Consumer
Products

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-238 (Rev B) Seat, Water Closet

CID A-A-240 (Basic) Shower Head, Ball Joint

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA-02 (1995) Copper Tube Handbook

COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO)

CABO A117.1 (1992; Errata Jun 1993) Accessible and Usable Buildings and Facilities

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
(FCCHR)

FCCHR-01 (1993) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58 (1993) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1996) Pipe Hangers and Supports - Selection and Application

MSS SP-70 (1990) Cast Iron Gate Valves, Flanged and Threaded Ends

MSS SP-73 (1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings

MSS SP-83 (1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS
(NAPHCC)

NAPHCC-01 (1996) National Standard Plumbing Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 (1992) National Fuel Gas Code

NFPA 90A (1993) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF Std 14 (1965; Rev Nov 1990) Plastics Piping Components and Related Materials

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01 (1991) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J1508 (1993) Hose Clamps

UNDERWRITERS LABORATORIES (UL)

UL 732 (1995) Oil-Fired Storage Tank Water Heaters

1.2 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Structural members shall be welded in accordance with Section 05055 WELDING, STRUCTURAL.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Plumbing System; GA.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-06 Instructions

Plumbing System; GA.

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and

hubless joints for cast iron soil pipe.

SD-09 Reports

Tests, Flushing and Sterilization; GA.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-19 Operation and Maintenance Manuals

Plumbing System; GA.

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.5 REGULATORY REQUIREMENTS

1.5.1 Plumbing

Plumbing work shall be in accordance with NAPHCC-01.

1.6 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II.

Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF Std 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe shall not be used under ground. Joints and gasket materials

shall conform to the following:

- a. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.
- b. Coupling for Steel Pipe: AWWA C606.
- c. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI HSN-85.
- d. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- e. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides. Silver brazing materials shall be in accordance with AWS A5.8.
- f. Solder Material: Solder metal shall conform to ASTM B 32 95-5 tin-antimony.
- g. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
- h. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.
- i. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings: ASTM C 564.
- j. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.
- k. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- l. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.
- m. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.
- n. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.
- o. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
- p. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: SAE J1508.

- e. Metallic Cleanouts: ASME A112.36.2M.
- f. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- g. Hypochlorites: AWWA B300.
- h. Liquid Chlorine: AWWA B301.
- i. Polyethylene Encasement for Ductile-Iron Piping: AWWA C105.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

| Description | Standard |
|---|----------------|
| Cast-Iron Gate Valves, Flanged and Threaded Ends | MSS SP-70 |
| Backwater Valves | ASME A112.14.1 |
| Water Heater Drain Valves | ASSE 1005 |
| Trap Seal Primer Valves | ASSE 1018 |
| Temperature and Pressure Relief Valves for Hot Water Supply Systems | ANSI Z21.22 |

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets (Hose Bibb)

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with NAPHCC-01. Fixtures for use by the physically handicapped shall be in accordance with CABO A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings.

Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, and pop-up stoppers of lavatory waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

2.4.1 Lavatories

Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR-01. Backflow preventers

with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or caulked connection. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.21.1M.

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws securing the clamping device shall be provided. Polyethylene drains shall have fittings to adapt drain to waste piping. Polyethylene for floor drains shall conform to ASTM D 1248. Drains shall have separate cast-iron "P" trap, circular body, seepage pan, and strainer, unless otherwise indicated.

2.6.1.2 Drains and Backwater Valves

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.7 SHOWER PAN

Shower pan may be copper, or nonmetallic material.

2.7.1 Sheet Copper

Sheet copper shall be 16 ounceweight.

2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 0.040 inch minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and shall be in accordance with ASTM D 4551.

2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 0.040 inch minimum thickness of nonplasticized PVC

and shall have the following minimum properties:

a. ASTM D 638:

| | |
|----------------------------|-------------|
| Ultimate Tensile Strength: | 2600 psi |
| Ultimate Elongation: | 398 percent |
| 100 Percent Modulus: | 445 psi |

b. ASTM D 1004:

| | |
|----------------|---------------------|
| Tear Strength: | 300 pounds per inch |
|----------------|---------------------|

c. ASTM E 96:

| | |
|------------|-------------|
| Permeance: | 0.008 perms |
|------------|-------------|

d. Other Properties:

| | |
|---|---------------------|
| Specific Gravity: | 1.29 |
| PVC Solvent: | Weldable |
| Cold Crack: | minus -53 degrees F |
| Dimensional stability, 212 degrees F minus 2.5 percent | |
| Hardness, Shore A: | 89 |

2.8 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.9 WATER HEATER

Water heater types and capacities shall be as indicated. Each primary water heater shall have controls adjustable from 90 to 120 degrees F. Each gas-fired water heater shall have controls adjustable from 120 to 180 degrees F. The thermal efficiencies and stand by heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that the storage capacity need not meet the standard loss requirement if the tank surface area is not insulated to R-12.5 and if a standing light is not used.

2.9.1 Automatic Storage Type

Heaters shall be complete with control system, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.9.2 Oil-Fired Type

Oil-fired type water heaters shall conform to UL 732.

2.9.3 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.1 when input is 75,000 Btu per hour or less or ANSI Z21.10.3 for heaters with input greater than 75,000 Btu per hour.

2.10 COMPRESSED AIR SYSTEM

2.10.1 Air Compressors

Air compressor unit shall be a factory-packaged assembly, including single phase, 230 volt motor controls, switches, wiring, accessories, and motor controllers, in a NEMA 250, Type 4 enclosure. Tank-mounted air compressors shall be manufactured to comply with UL listing requirements. Air compressors shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment.

Each compressor shall start and stop automatically at upper and lower pressure limits of the system. Guards shall shield exposed moving parts. Each compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer shall be provided with each compressor. Aftercooler and moisture separator shall be installed between compressors and air receiver to remove moisture and oil condensates before the air enters the receiver. Aftercoolers shall be air-cooled. The air shall pass through a sufficient number of tubes to affect cooling. Tubes shall be sized to give maximum heat transfer. Water to unit shall be controlled by a solenoid or pneumatic valve which opens when the compressors start and closes when the compressors shut down. Cooling capacity of the aftercooler shall be sized for the total capacity of the compressors. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers shall be as indicated.

2.10.2 Air Receivers

Receivers shall be designed for 200 psi working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. Receivers shall be equipped with safety relief valves and accessories, including pressure gauges and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers shall be designed and constructed in accordance with ASME BPV VIII Div 1 and shall have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code shall be provided.

2.10.3 Intake Air Supply Filter

Dry type air filter shall be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media shall withstand a maximum 125 psi, capacity as indicated.

2.10.4 Pressure Regulators

The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 125 psi and a maximum temperature of 200 degrees F. Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve shall include a pressure gauge and shall be provided with an adjustment screw for adjusting the pressure differential from 0 to 125 psi. Regulator shall be sized as indicated.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Hubless cast-iron pipe shall not be installed under concrete floor slabs. Piping located in air plenums shall conform to NFPA 90A requirements. Unprotected plastic pipe shall not be installed in air plenum. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation.

Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains shall consist of 3/4 inch hose bibb with renewable seat and gate valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

3.1.1.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access

doors or removable panels. Commercial-type water hammer arresters shall conform to PDI WH 201. Vertical capped pipe columns will not be permitted.

3.1.2 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 125 psig working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 Union

Unions shall not be concealed in walls, ceilings, or partitions.

3.1.3.3 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.3.4 Copper Tube and Pipe

The tube or fittings shall not be annealed when making connections. Connections shall be made with a multiflame torch.

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA-02 with flux and are acceptable for line sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA-02.
- c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall

be provided. Branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

3.1.3.5 Plastic Pipe

PVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.3.6 Corrosive Waste Plastic Pipe

Joints for polyolefin pipe and fittings shall be made by mechanical joint or electrical fusion coil method in accordance with ASTM D 2657 and ASTM F 1290. Joints for filament-wound reinforced thermosetting resin pipe shall be made in accordance with manufacturer's instructions. Unions or flanges shall be used where required for disconnection and inspection.

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper pipe shall be made with dielectric unions or flange waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Corrosion Protection for Buried Pipe and Fittings

3.1.5.1 Cast Iron and Ductile Iron

Pipe, fittings, and joints shall have a protective coating. The protective coating shall be completely encasing polyethylene tube or sheet in accordance with AWWA C105. Joints and fittings shall be cleaned, coated with primer, and wrapped with tape. The pipe shall be cleaned, coated, and wrapped prior to pipe tightness testing. Joints and fittings shall be cleaned, coated, and wrapped after pipe tightness testing. Tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer shall be as recommended by the tape manufacturer.

3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.6.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with

a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07900 JOINT SEALING. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant.

3.1.6.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.6.4 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900 JOINT SEALING.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

3.1.7.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.

- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
 - (1) Be used on insulated pipe less than 4 inches.
 - (2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.
 - (3) Have a high density insert for pipe 2 inches and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High density inserts shall have a density of 8 pcf or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 40 shields used on insulated pipe shall have high density inserts with a density of 8 pcf or greater.
- l. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

- (1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.
- (2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- (3) On pipe 4 inches and larger carrying medium less than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- m. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
- n. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
- o. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.8 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Installation of Gas-Fired Water Heater

Installation shall conform to NFPA 54 for gas fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 24 inches just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

3.2.3 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene

gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor.

3.3.3 Height of Fixture Rims Above Floor

Installation of fixtures for use by the physically handicapped shall be in accordance with CABO A117.1.

3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.5.2 Support for Cellular-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the cellular wall using through bolts and a back-up plate.

3.3.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs

shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with NAPHCC-01 at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.7 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.3.9 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.3.9.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 6 inches for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3.9.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flatlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 gallon per 50 square feet. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.3.9.3 Nonplasticized Chlorinated Polyethylene Shower Pans

Corners of nonplasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 1/2 inch from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 1/2 inch from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 40 degrees F the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 15 pound dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.9.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 6 inches in room areas and 3 inches above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 1 inch of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when

setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and grime). Sheets shall be laid on a flat surface with an overlap of about 2 inches. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 2 or 3 feet at a time shall be welded. On wood subflooring, two layers of 15 pound felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

3.4.1 Compressors

Floor attachment shall be as recommended by compressor manufacturer.

3.5 IDENTIFICATION SYSTEMS

3.5.1 Color Coding

Color coding for piping identification shall be as specified in Section 09900 PAINTING, GENERAL.

3.6 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.7 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTING, GENERAL.

3.8 TESTS FLUSHING AND STERILIZATION

3.8.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC-01.

3.8.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of

Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

| | |
|------------------------|---------------------------------------|
| Data on Device | Data on Testing Firm |
| Type of Assembly | Name |
| Manufacturer | Address |
| Model Number | Certified Tester |
| Serial Number | Certified Tester No. |
| Size | Date of Test |
| Location | |
| Test Pressure Readings | Serial Number and Test Data of Gauges |

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.8.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.8.1.3 Compressed Air Piping (Nonoil-Free)

Piping systems shall be filled with oil-free dry air or gaseous nitrogen to 150 psig and hold this pressure for 2 hours with no drop in pressure.

3.8.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be permitted.

3.8.3 System Flushing

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.8.4 Operational Test

Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each

system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Temperature of each domestic hot-water supply.
- f. Operation of each floor drain by flooding with water.
- g. Operation of each vacuum breaker and backflow preventer.
- h. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.8.5 Disinfection

After pressure tests have been made, the entire domestic hot- and cold-water distribution system shall be sterilized. System shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.9 PLUMBING FIXTURE SCHEDULE

P-1 LAVATORY:

Manufacturer's standard sink depth, enameled cast iron ASME A112.19.1M, countertop.

Faucet - Faucets shall be single center set type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. The flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

Handles - Lever type. Cast, formed, or drop forged copper alloy.

Drain - Pop-up drain shall include stopper, lift rods, jam nut, washer, and tail piece. See paragraph FIXTURES for optional plastic accessories.

P-2 SHOWER:

Shower heads, CID A-A-240 other than emergency showers, shall include a non-removable, tamperproof device to limit water flow to 2.5 gpm when tested in accordance with ASME A112.18.1M.

Wall Mounted: Shower head shall be nonadjustable spray, stainless steel or chromium plated brass with ball joint. Handles shall be chrome-plated die cast zinc alloy. Control valves shall be copper alloy and have metal integral parts of copper alloy, nickel alloy, or stainless steel. Valves shall be single lever type. Shower head shall be vandalproof with integral back.

P-3 URINAL (TROUGH TYPE)

Urinal shall be 14 gauge type 304 stainless steel, trough type. Construction shall be all welded with visible welds ground smooth. Exterior shall be polished to a satin finish. Corners shall be large radius to facilitate cleaning. Bottom of urinal shall be sloped to integrally welded high capacity stainless steel beehive dome strainer with a minimum of 3 square inches of free area. Urinals shall be provided with a 1-1/2 inch waste connection on bottom. Urinals shall be provided without p-trap or supply connections. Urinals in the shower and latrine building shall be provided with a means of joining the two urinals together. Urinal shall be 5 feet long.

P-4 WATERLESS TOILET STOOL

Waterless toilet stool shall be 24 gauge type 304 stainless steel with spot welded joints and one inch wide floor flange designed to mount over vented concrete pit. The floor flange shall be provided with 1/4 inch anchor holes to anchor to floor. Below floor flange extension shall be 12 inches long. Seat and cover shall be constructed of solid plastic. The seat shall be coated with white vinyl. Stools shall be provided with stainless steel hinges for the seat and cover and shall be provided with lift tabs for the seat cover.

P-5 WHEELCHAIR LAVATORY:

Vitreous china, ASME A112.19.2M, wheelchair lavatory with wrist or elbow controls 20 inches wide x 27 inches deep with gooseneck spout. The flow shall be limited to 2.5 gpm at a flowing water pressure of 80 psi.

Drain - Strainer shall be copper alloy or stainless steel.

P-6 WATER CLOSET HANDICAPPED:

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted
Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Top rim of bowl shall be 18 inches above the finished floor.

Seat - CID A-A-238, Type A, white plastic, elongated, open front.

Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 2-5/8 inches at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 1.6 gallons per flush.

3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

3.11.1 Storage Water Heaters

3.11.1.1 Gas

- a. Storage capacity of 100 gallons or less, and input rating of 75,000 Btu/h or less: minimum EF shall be 0.62-0.0019V per 10 CFR

430.

- b. Storage capacity of more than 100 gallons - or input rating more than 75,000 Btu/h: Et shall be 77 percent; maximum SL shall be $1.3+38/V$, per ANSI Z21.10.3.

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

| | | SERVICE | | | | | |
|--------|---|---------|---|---|---|---|---|
| Item # | Pipe and Fitting Materials | A | B | C | D | E | F |
| 1 | Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets | X | X | X | X | X | |
| 2 | Cast iron pipe and fittings hubless, CISPI 301 and ASTM A 888 | X | X | X | X | | |
| 3 | Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10 | X | | X | X | | |
| 4 | Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10 | | | | X | X | |
| 5 | Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) | X | X | X | X | X | X |
| 6 | Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996 | | | | | | X |

SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
 B - Aboveground Soil, Waste, Drain In Buildings
 C - Underground Vent
 D - Aboveground Vent
 E - Interior Rainwater Conductors Aboveground
 F - Corrosive Waste And Vent Above And Belowground
 * - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

| Item No. | Pipe and Fitting Materials | SERVICE | | | |
|----------|--|---------|-----|-----|------|
| | | A | B | C | D |
| 1 | Steel pipe: a. Seamless, galvanized, ASTM A 53, Type S, Grade B | X | X | X | X |
| | b. Seamless, black, ASTM A 53, Type S, Grade B | | | X | |
| 2 | Bronze flanged fittings, ASME B16.24 for use with Item 4 | X | X | | X |
| 3 | Seamless copper pipe, ASTM B 42 | X | X | | X |
| 4 | Seamless copper water tube, ASTM B 88 | X** | X** | X** | X*** |
| 5 | Cast bronze threaded fittings, ASME B16.15 for use with Items 7 and 8 | X | X | | X |
| 6 | Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 7 and 8 | X | X | X | X |
| 7 | Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 7 and 8 | X | X | X | X |
| 8 | Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D 1785 | X | | | X |
| 9 | Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D 2241 | X | | | X |
| 10 | Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D 2466 | X | | | X |
| 11 | Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2467 | X | | | X |
| 12 | Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D 2464 | X | | | X |
| 13 | Joints for IPS pvs pipe using solvent cement, ASTM D 2672 | X | | | X |
| 14 | Fittings: brass or bronze; | X | X | | |

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

| Item No. | Pipe and Fitting Materials | SERVICE | | | |
|----------|---|---------|---|---|---|
| | | A | B | C | D |
| | ASME B16.15, and ASME B16.18 ASTM B 828 | | | | |
| 15 | Carbon steel pipe unions, socket-welding and threaded, MSS SP-83 | X | X | X | |
| 16 | Malleable-iron threaded pipe unions ASME B16.39 | X | X | | |
| 17 | Nipples, pipe threaded ASTM A 733 | X | X | X | |

A - Cold Water Aboveground

B - Hot Water 180 degrees F Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper
without joints in or under floors

**** - In or under slab floors only brazed joints

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING
EQUIPMENT

A. STORAGE WATER HEATERS

| FUEL | STORAGE CAPACITY GALLONS | INPUT RATING | TEST PROCEDURE | REQUIRED PERFORMANCE |
|------|--------------------------------|-----------------|----------------|--|
| Gas | 100 min. OR | 75,000 Btu/h | ANSI Z21.10.3 | ET = 77 percent; SL = $1.3 + 38/V$ max. |

B. Unfired Hot Water Storage, instantaneous water heater, and pool heater.

Volumes and inputs: maximum HL shall be 6.5 Btu/h/sq. ft.

TERMS:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0
(trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in
percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area

V = Storage volume in gallons

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15488

GAS PIPING SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Standard Products
 - 1.2.2 Verification of Dimensions
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 PIPE AND FITTINGS
 - 2.1.1 Steel Pipe, Joints, and Fittings
 - 2.1.2 Copper Tubing, Joints and Fittings
 - 2.1.3 Steel Tubing, Joints and Fittings
 - 2.1.4 Thermoplastic Pipe, Tubing, Joints, and Fittings
 - 2.1.5 Fiberglass Pipe, Joints, and Fittings
 - 2.1.6 Sealants for Steel Pipe Threaded Joints
 - 2.1.7 Identification
 - 2.1.8 Flange Gaskets
 - 2.1.9 Pipe Threads
 - 2.1.10 Escutcheons
 - 2.1.11 Insulating Pipe Joints
 - 2.1.11.1 Insulating Joint Material
 - 2.1.11.2 Threaded Pipe Joints
- 2.2 VALVES
 - 2.2.1 Valves 2 Inches and Smaller
 - 2.2.2 Valves 2-1/2 Inches and Larger
- 2.3 PIPE HANGERS AND SUPPORTS
- 2.4 METERS, REGULATORS AND SHUTOFF VALVES
- 2.5 UNIT HEATERS
 - 2.5.1 Gas-Fired Unit Heater
 - 2.5.1.1 Casing
 - 2.5.1.2 Heat Exchanger
 - 2.5.1.3 Burners
 - 2.5.1.4 Draft Diverter
 - 2.5.1.5 Controls
 - 2.5.1.6 Accessories
 - 2.5.2 Electric Unit Heater
 - 2.5.2.1 Casing
 - 2.5.2.2 Heating Element
 - 2.5.2.3 Controls

PART 3 EXECUTION

- 3.1 EXCAVATION AND BACKFILLING
- 3.2 GAS PIPING SYSTEM

- 3.2.1 Protection of Materials and Components
- 3.2.2 Workmanship and Defects
- 3.3 PROTECTIVE COVERING
 - 3.3.1 Underground Metallic Pipe
 - 3.3.2 Aboveground Metallic Piping Systems
 - 3.3.2.1 Ferrous Surfaces
 - 3.3.2.2 Nonferrous Surfaces
- 3.4 INSTALLATION
 - 3.4.1 Metallic Piping Installation
 - 3.4.2 Metallic Tubing Installation
 - 3.4.3 Concealed Piping in Buildings
 - 3.4.3.1 Piping in Partitions
 - 3.4.4 Aboveground Piping
 - 3.4.5 Final Gas Connections
- 3.5 PIPE JOINTS
 - 3.5.1 Threaded Metallic Joints
 - 3.5.2 Flared Metallic Tubing Joints
 - 3.5.3 Solder or Brazed Joints
- 3.6 PIPE SLEEVES
- 3.7 PIPES PENETRATING WATERPROOFING MEMBRANES
- 3.8 ESCUTCHEONS
- 3.9 SPECIAL REQUIREMENTS
- 3.10 BUILDING STRUCTURE
- 3.11 PIPING SYSTEM SUPPORTS
- 3.12 ELECTRICAL BONDING AND GROUNDING
- 3.13 SHUTOFF VALVE
- 3.14 TESTING
 - 3.14.1 Pressure Tests
 - 3.14.2 Pressure Tests for Liquefied Petroleum Gas
 - 3.14.3 Test With Gas
 - 3.14.4 Purging
 - 3.14.5 Labor, Materials and Equipment

-- End of Section Table of Contents --

SECTION 15488

GAS PIPING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN GAS ASSOCIATION (AGA)

AGA-01 (1989) A.G.A. Plastic Pipe Manual for Gas Service

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994) Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 539 (1990a) Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines

ASTM B 88 (1995a) Seamless Copper Water Tube

ASTM B 280 (1993a) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM D 2513 (1995c) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D 2517 (1981; R 1987) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.3 (1992) Malleable Iron Threaded Fittings

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.33 (1990) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (Sizes 1/2 through 2)

ASME B36.10M (1985; R 1994) Welded and Seamless Wrought Steel Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

| | |
|-----------|---|
| MSS SP-25 | (1993) Standard Marking System for Valves, Fittings, Flanges and Unions |
| MSS SP-58 | (1993) Pipe Hangers and Supports - Materials, Design and Manufacture |
| MSS SP-69 | (1991) Pipe Hangers and Supports - Selection and Application |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---------|---------------------------------|
| NFPA 54 | (1992) National Fuel Gas Code |
| NFPA 70 | (1996) National Electrical Code |

UNDERWRITERS LABORATORIES (UL)

| | |
|-------|---|
| UL-06 | (1994; Supple; Rev thru March 1996) Gas and Oil Equipment Directory |
|-------|---|

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Manufacturer's descriptive data and installation instructions shall be submitted for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Valves, flanges and fittings shall be marked in accordance with MSS SP-25.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Gas Piping System; GA

Drawings showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of connectors and supports.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Steel Pipe, Joints, and Fittings

Steel pipe shall conform to ASME B36.10M. Malleable-iron threaded fittings shall conform to ASME B16.3.

2.1.2 Copper Tubing, Joints and Fittings

Copper tubing shall conform to ASTM B 88, Type K or L, or ASTM B 280. Tubing joints shall be made up with tubing fittings recommended by the tubing manufacturer.

2.1.3 Steel Tubing, Joints and Fittings

Steel tubing shall conform to ASTM A 539. Tubing joints shall be made up with gas tubing fittings recommended by the tubing manufacturer.

2.1.4 Thermoplastic Pipe, Tubing, Joints, and Fittings

Thermoplastic pipe, tubing, joints and fittings shall conform to ASTM D 2513.

2.1.5 Fiberglass Pipe, Joints, and Fittings

Fiberglass piping systems shall conform to ASTM D 2517.

2.1.6 Sealants for Steel Pipe Threaded Joints

Joint sealing compound shall be listed in UL-06, Class 20 or less. Tetrafluoroethylene tape shall conform to UL-06.

2.1.7 Identification

Pipe flow markings and metal tags shall be provided as required.

2.1.8 Flange Gaskets

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum 600 degree F service. NBR binder shall be used for hydrocarbon service.

2.1.9 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.1.10 Escutcheons

Escutcheons shall be chromium-plated steel or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screw.

2.1.11 Insulating Pipe Joints

2.1.11.1 Insulating Joint Material

Insulating joint material shall be provided between flanged or threaded

metallic pipe systems where shown to control galvanic or electrical action.

2.1.11.2 Threaded Pipe Joints

Joints for threaded pipe shall be steel body nut type dielectric unions with insulating gaskets.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Valves 2 Inches and Smaller

Valves 2 inches and smaller shall conform to ASME B16.33 and shall be of materials and manufacture compatible with system materials used.

2.2.2 Valves 2-1/2 Inches and Larger

Valves 2-1/2 inches and larger shall be carbon steel conforming to API Spec 6D, Class 150.

2.3 PIPE HANGERS AND SUPPORTS

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69.

2.4 METERS, REGULATORS AND SHUTOFF VALVES

Meters, regulators and shutoff valves shall be as specified on drawings.

2.5 UNIT HEATERS

Self-contained and factory assembled, propeller or centrifugal fan with capacities expressed as BTU per hour output and cubic foot-per minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct drive. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Provide thermostats. Furnish circuit breaker disconnect switch.

2.5.1 Gas-Fired Unit Heater

ANSI Z83.8 and AGA label.

2.5.1.1 Casing

Minimum 20 gauge all-welded steel construction with corrosion-resistant aluminum finish.

2.5.1.2 Heat Exchanger

Minimum 20 gauge all-welded steel construction with corrosion-resistant aluminum finish.

2.5.1.3 Burners

Die-formed, slot ports, and steel construction with aluminum paint.

2.5.1.4 Draft Diverter

All-welded steel construction and an integral part of each heat exchanger section. Allows backdrafts to bypass burner assembly without affecting normal operation.

2.5.1.5 Controls

Consisting of a combination pressure regulator, main shutoff valve, pilot cock, pilot safety switch for 100 percent shutoff, high temperature limit switch, and time-delay fan switch. Include power and control connections in an integral junction box.

2.5.1.6 Accessories

Provide propane-gas conversion kit.

2.5.2 Electric Unit Heater

UL listed; wattage, voltage, phase, and number of steps as indicated.

Provide control-circuit terminals and single source of power supply. Limit leaving air temperature below 140 degrees F at 60 degrees F entering air.

2.5.2.1 Casing

Minimum 21 gauge steel.

2.5.2.2 Heating Element

Nickel-chromium heating wire element, free from expansion noise and 60 Hz hum. Embed element in magnesium-oxide insulating refractory. Seal element in high-mass steel or corrosion-resisting metallic sheath with fins. Enclose element ends in terminal box. Space fins at maximum six fins per inch. Limit fin surface temperature 550 degrees F at any point during normal operation.

2.5.2.3 Controls

Include limit controls for thermal overheat protection of heaters. For remote thermostatic operation, provide contactor rated for 100,000 duty cycles. Provide room thermostat for pilot duty.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 GAS PIPING SYSTEM

Gas piping system shall be from the point of delivery, defined as the outlet of the LP tank regulator, to the connections to each gas utilization device.

3.2.1 Protection of Materials and Components

Pipe and tube openings shall be closed with caps or plugs during

installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage. At the completion of all work, the entire system shall be thoroughly cleaned.

3.2.2 Workmanship and Defects

Piping, tubing and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip-and scale-blown. Defects in piping, tubing or fittings shall not be repaired. When defective piping, tubing, or fittings are located in a system, the defective material shall be replaced.

3.3 PROTECTIVE COVERING

3.3.1 Underground Metallic Pipe

Buried metallic piping shall be protected from corrosion with protective coatings on drawings. When dissimilar metals are joined underground, gastight insulating fittings shall be used.

3.3.2 Aboveground Metallic Piping Systems

3.3.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer. Surfaces that have not been shop primed shall be solvent cleaned. Surfaces that contain loose rust, loose mill scale and other foreign substances shall be mechanically cleaned by power wire brushing and primed with ferrous metal primer. Primed surface shall be finished with two coats of exterior oil paint.

3.3.2.2 Nonferrous Surfaces

Except for aluminum alloy pipe, nonferrous surfaces shall not be painted. Surfaces of aluminum alloy pipe and fittings shall be painted to protect against external corrosion where they contact masonry, plaster, insulation, or are subject to repeated wettings by such liquids as water, detergents or sewage. The surfaces shall be solvent-cleaned and treated with vinyl type wash coat. A first coat of aluminum paint and a second coat of alkyd gloss enamel or silicone alkyd copolymer enamel shall be applied.

3.4 INSTALLATION

Installation of the gas system shall be in conformance with the manufacturer's recommendations and applicable provisions of NFPA 54, AGA-01, and as indicated. Pipe cutting shall be done without damage to the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 6 inches and larger, an approved gas cutting and beveling machine may be used.

3.4.1 Metallic Piping Installation

Underground piping shall be buried a minimum of 18 inches below grade. Changes in direction of piping shall be made with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced

against external strains.

3.4.2 Metallic Tubing Installation

Metallic tubing shall be installed using gas tubing fittings approved by the tubing manufacturer. Branch connections shall be made with tees. All tubing end preparation shall be made with tools designed for the purpose.

3.4.3 Concealed Piping in Buildings

When installing piping which is to be concealed, unions, tubing fittings, running threads, right- and left-hand couplings, bushings, and swing joints made by combinations of fittings shall not be used.

3.4.3.1 Piping in Partitions

Concealed piping shall be located in hollow rather than solid partitions. Tubing passing through walls or partitions shall be protected against physical damage.

3.4.4 Aboveground Piping

Aboveground piping shall be run as straight as practicable along the alignment indicated and with a minimum of joints. Piping shall be separately supported. Exposed horizontal piping shall not be installed farther than 6 inches from nearest parallel wall in laundry areas where clothes hanging could be attempted.

3.4.5 Final Gas Connections

Unless otherwise specified herein, final connections shall be made with rigid metallic pipe and fittings. In addition to cautions listed in instructions required by ANSI standards for flexible connectors, insure that flexible connectors do not pass through equipment cabinet. Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.5 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.5.1 Threaded Metallic Joints

Threaded joints in metallic pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, pipe shall be reamed and burrs shall be removed. Caulking of threaded joints to stop or prevent leaks shall not be permitted.

3.5.2 Flared Metallic Tubing Joints

Flared joints in metallic tubing shall be made with special tools recommended by the tubing manufacturer. Flared joints shall be used only in systems constructed from nonferrous pipe and tubing, when experience or tests have demonstrated that the joint is suitable for the conditions, and

when adequate provisions are made in the design to prevent separation of the joints. Metallic ball sleeve compression-type tubing fittings shall not be used for tubing joints.

3.5.3 Solder or Brazed Joints

Joints in metallic tubing and fittings shall be made with materials and procedures recommended by the tubing supplier. Joints shall be brazed with material having a melting point above 1000 degrees F. Brazing alloys shall not contain phosphorous.

3.6 PIPE SLEEVES

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be installed in structural members except where indicated or approved. Each sleeve shall extend through its respective wall, floor or roof, and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall be large enough to provide a minimum clearance of 1/4 inch all around the pipe. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic.

3.7 PIPES PENETRATING WATERPROOFING MEMBRANES

Pipes penetrating waterproofing membranes shall be installed as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

3.8 ESCUTCHEONS

Escutcheons shall be provided for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.9 SPECIAL REQUIREMENTS

Drips, grading of the lines, freeze protection, and branch outlet locations shall be as shown and shall conform to the requirements of NFPA 54.

3.10 BUILDING STRUCTURE

Building structure shall not be weakened by the installation of any gas piping. Beams or joists shall not be cut or notched.

3.11 PIPING SYSTEM SUPPORTS

Gas piping systems in buildings shall be supported with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Gas piping system shall not be supported by other piping. Spacing of supports in gas piping and tubing installations shall conform to the requirements of NFPA 54. The selection and application of supports in gas piping and tubing installations shall conform to the requirements of MSS SP-69. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. The clips or clamps shall be rigidly connected to the

common base member. A clearance of 1/8 inch shall be provided between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.12 ELECTRICAL BONDING AND GROUNDING

A gas piping system within a building shall be electrically continuous and bonded to a grounding electrode as required by NFPA 70.

3.13 SHUTOFF VALVE

Main gas shutoff valve controlling the gas piping system shall be easily accessible for operation and shall be installed as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled.

3.14 TESTING

Before any section of a gas piping system is put into service, it shall be carefully tested to assure that it is gastight. Prior to testing, the system shall be blown out, cleaned and cleared of all foreign material. Each joint shall be tested by means of an approved gas detector, soap and water, or an equivalent nonflammable solution. Testing shall be completed before any work is covered, enclosed, or concealed. All testing of piping systems shall be done with due regard for the safety of employees and the public during the test. Bulkheads, anchorage and bracing suitably designed to resist test pressures shall be installed if necessary. Oxygen shall not be used as a testing medium.

3.14.1 Pressure Tests

Before appliances are connected, piping systems shall be filled with air or an inert gas and shall withstand a minimum pressure of 3 pounds gauge for a period of not less than 10 minutes as specified in NFPA 54 without showing any drop in pressure. Oxygen shall not be used. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device so calibrated as to be read in increments of not greater than 0.1 pound. The source of pressure shall be isolated before the pressure tests are made.

3.14.2 Pressure Tests for Liquified Petroleum Gas

Systems shall withstand the pressure test described above. When appliances are connected to the piping system, fuel gas shall be used for testing and appliances shall withstand a pressure of not less than 10.0 inches nor more than 14.0 inches water column (8.0 ounces per square inch) for a period of not less than 10 minutes without showing any drop in pressure. Pressure shall be measured with a water manometer or an equivalent device calibrated to be read in increments of not greater than 0.1 inch water column. The source of pressure shall be isolated before the pressure tests are made.

3.14.3 Test With Gas

Before turning gas under pressure into any piping, all openings from which gas can escape shall be closed. Immediately after turning on the gas, the piping system shall be checked for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. All testing shall conform to the requirements of NFPA 54. If leakage is recorded, the gas supply shall be shut off, the leak shall be repaired, and the tests repeated until all leaks have been stopped.

3.14.4 Purging

After testing is completed, and before connecting any appliances, all gas piping shall be fully purged. LPG piping tested using fuel gas with appliances connected does not require purging. Piping shall not be purged into the combustion chamber of an appliance. The open end of piping systems being purged shall not discharge into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 54 are followed.

3.14.5 Labor, Materials and Equipment

All labor, materials and equipment necessary for conducting the testing and purging shall be furnished by the Contractor.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15566

WARM AIR HEATING SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Standard Products
 - 1.2.2 Nameplates
 - 1.2.3 Verification of Dimensions
 - 1.2.4 SUBMITTALS
- 1.3 DELIVERY AND STORAGE
- 1.4 ELECTRICAL WORK

PART 2 PRODUCTS

- 2.1 SELF-CONTAINED FURNACE
 - 2.1.1 Gas-Fired Unit
- 2.2 FURNACE COMPONENTS
 - 2.2 Gas-Burning Components
- 2.3 Ignition Systems
 - 2.2.3.1 Gas-Fired Units
- 2.4 Supply Blowers
 - 2.2.5 Vents for Conventional furnaces
- 2.5 CONTROLS
- 2.6 FAN
- 2.7 MOTOR AND STARTER
- 2.7 GAS PIPING SYSTEM AND FLUE VENT
- 2.7 AIR FILTERS
 - 2.7.1 Replaceable Media filters
- 2.8 FUEL-GAS SUPPLY SYSTEM
- 2.9 DUCTWORK COMPONENTS
 - 2.9.1 Metal Ductwork
 - 2.9.1.1 Transitions
 - 2.9.1.2 General Service Duct Connectors
 - 2.9.3 Ductwork Accessories
 - 2.9.3.1 Duct Access Doors
 - 2.9.3.3 Manual Balancing Dampers
 - 2.9.3.4 Air Deflectors and Branch Connections
 - 2.9.5 Diffusers, Registers, and Grilles
 - 2.9.5.1 Diffusers
 - 2.9.5.2 Registers and Grilles
 - 2.9.6 Louvers
- 2.10 FACTORY PAINTING

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.1 Furnaces

- 3.2 Gas Fired and Electric Unit Heaters
- 3.3 Access Panels
- 3.4 Flexible Connectors
- 3.5 Metal Ductwork
- 3.6 Air Filters
- 3.7 Dust Control
- 3.8 Insulation
 - 3.1.12 Duct Test Holes
- 3.2 FIELD PAINTING
- 3.9 CLEANING
- 3.10 TESTS
 - 3.10.1 Testing, Adjusting, and Balancing
 - 3.10.2 Performance Tests
- 3.11 FIELD TRAINING

-- End of Section Table of Contents --

SECTION 15566

WARM AIR HEATING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR DIFFUSION COUNCIL (ADC)

ADC 1062:GRD (1984) Test Codes for Grilles, Registers, and Diffusers

AMERICAN GAS ASSOCIATION LABORATORIES (AGAL)

AGAL-01 (1996) Directory of Certified Appliances and Accessories

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.47 (1993) Gas-Fired Central Furnaces (Except Direct Vent Central Furnaces

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653 (1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B 117 (1994) Operating Salt Spray (Fog) Testing Apparatus

ASTM D 520 (1984; R 1989) Zinc Dust Pigment

ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 3359 (1995) Measuring Adhesion by Tape Test

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1 (1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1993) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|---|
| NFPA 54 | (1992) National Fuel Gas Code |
| NFPA 90A | (1993) Installation of Air Conditioning and Ventilating Systems |
| NFPA 90B | (1993) Warm Air Heating and Air Conditioning Systems |
| NFPA 211 | (1992) Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances |

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

| | |
|-----------|--|
| SMACNA-06 | (1985) HVAC Duct Construction Standards - Metal and Flexible |
|-----------|--|

UNDERWRITERS LABORATORIES (UL)

| | |
|--------|---|
| UL-01 | (1996; Supple) Building Materials Directory |
| UL 214 | (1993) Tests for Flame-Propagation of Fabrics and Films |
| UL 900 | (1994) Test Performance of Air Filter Units |

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. Equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

1.2.3 Verification of Dimensions

The Contractor shall become familiar with all details of the work and working conditions, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Heating Equipment; GA.

Spare parts data for each different item of material and equipment specified, after approval of detail drawings and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 12 months operation, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 year(s) of service.

SD-04 Drawings

Heating Equipment; GA.

Drawings shall consist of a complete list of equipment and material including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Drawings shall contain complete equipment wiring diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenance and equipment relationship to other parts of the work including clearances required for maintenance and operation.

SD-09 Reports

Tests; GA.

Test reports for the performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-19 Operation and Maintenance Manuals

Heating Equipment; GA.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tool that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics

and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be in accordance with NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

PART 2 PRODUCTS

2.1 SELF-CONTAINED FURNACE

Furnace shall be a manufacturer's standard, self-contained, forced circulated air heating type furnace as indicated. Furnace and furnace components shall be completely factory-assembled and wired. Furnace casing shall be factory insulated and be compatible with the operating temperatures. Furnace shall be provided with removable service panels which allow access to all internal components requiring cleaning, servicing, or adjustment.

2.1.1 Gas-Fired Unit

Gas-fired furnace shall be the conventional type in accordance with ANSI Z21.47. Furnace design shall be certified by the AMERICAN GAS ASSOCIATION LABORATORIES (AGA). Furnace shall have a minimum certified Annual Fuel Utilization Efficiency (AFUE) of not less than 78 percent.

2.2 FURNACE COMPONENTS

2.2 Gas-Burning Components

Gas-burning equipment shall include the gas burners, ignition equipment, gas-control valve, gas piping, gas-pressure regulating valve, when applicable, and accessories necessary for a fully automatic system that is listed in AGAL-01. Gas-fired units equipped with programming controls shall be furnished both with high and with low gas supply pressure switches in the fuel supply piping.

2.3 Ignition Systems

2.2.3.1 Gas-Fired Units

Ignition systems shall be of the direct spark, hot surface, or interrupted intermittent type with automatic electric ignition. The pilots shall be of the electrically-ignited proven type. Continuous pilots will not be permitted. Burner shall be designed in accordance with NFPA 54 and located so that parts are protected against overheating. Provisions shall be made in the burner housing for inspection of the pilot flame.

2.4 Supply Blowers

Blowers shall be centrifugal type. Blowers shall be statically and dynamically balanced. Lubrication points shall be located or extended, as

required, to provide ready access for periodic lubrication. The direction of rotation shall be clearly and permanently marked on each blower housing. Blower speeds shall be single, or multispeed, as indicated, to provide the specified range of air temperature rises. Direct-drive blowers may have multiple speed motors to change blower speed. Belt-drive blowers shall be provided with an adjustable base and guard or enclosed in the unit casing. The belt drive shall be designed in accordance with the applicable Rubber Manufacturer's Association (RMA) power transmission belt specifications, with a service factor of at least 1.2. Shafts shall be supported by a minimum of two self-aligning bearings. Blower speed shall be adjusted by the use of variable pitch drive sheaves.

2.2.5 Vents for Conventional furnaces

A 0.3125 inch diameter hole shall be provided in the vent stack not greater than 6 inches from the furnace flue outlet for sampling of the exit gases. A method shall be provided to seal the hole to prevent exhaust gases from entering the indoor space when samples are not being taken. Each exhaust stack shall be provided complete with bird screen and rain hood.

</SPT = 2.3 WIRING

Completely factory-prewired to terminal strips, ready to receive branch circuit and control connections for 60 degrees C copper wiring.

2.5 CONTROLS

Controls shall be provided as specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

2.6 FAN

Provide steel or aluminum fans with ball or roller bearing for motors over 1/8 horsepower (hp) and sleeve bearing for motors 1/8 hp and under. Provide sleeve bearings with oil reservoir, if not permanently lubricated. ANSI Z21.66.

2.7 MOTOR AND STARTER

NEMA MG 1, and NEMA ICS 2, and NEMA ICS 6, respectively. Provide continuous-duty motor with built-in automatic reset thermal overload protection. Provide single-phase motor of permanent split capacitor or capacitor start. Limit motor speed at 1800 r/min. Wire motor to heater power supply source.

2.7 GAS PIPING SYSTEM AND FLUE VENT

Comply with Section 15488 "Gas Piping Systems" for gas valves and piping. Use UL 441 flue vents.

2.7 AIR FILTERS

Air Filters shall be listed in accordance with requirements of UL 900.

2.7.1 Replaceable Media filters

Replaceable media filters shall be the dry-media type, of the size required to suit the application. Filtering media shall be not less than 2 inches

thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Pad shall be enclosed in a holding frame of not less than 16 gauge galvanized steel, and equipped with quick-opening mechanism for changing filter media. The air flow capacity of the filter shall be based on net filter face velocity not exceeding 300 feet per minute, with initial resistance of 0.13 inches water gauge. Average efficiency shall be not less than 30 percent when tested according to ASHRAE 52.1.

2.8 FUEL-GAS SUPPLY SYSTEM

Fuel-gas supply system shall be as specified in Section 15488 GAS PIPING SYSTEMS.

2.9 DUCTWORK COMPONENTS

2.9.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with SMACNA-06 unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 1/2, 1, and 2 inch w.g. ductwork shall meet the requirements of Seal Class C. Class 3 through 10 inch shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA-06. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable.

2.9.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.9.1.2 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL-01.

2.9.3 Ductwork Accessories

2.9.3.1 Duct Access Doors

Access doors shall be provided in ductwork where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA-06. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 by 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 by 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.9.3.3 Manual Balancing Dampers

Manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portion of the building, operators shall be chromium plated with all exposed edges rounded. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers shall be 2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrew. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.9.3.4 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections may be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air

deflectors, also called turning vanes, shall be provided in all 90 degree elbows.

2.9.5 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified in accordance with ADC 1062:GRD. Inlets and outlets shall be sound rated and certified in accordance with ADC 1062:GRD. Sound power level shall be as indicated. Diffusers and registers shall be provided with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device will be acceptable. Volume dampers shall be opposed blade type for all diffusers and registers. Where the inlet and outlet openings are located less than 7 feet above the floor, they shall be protected by a grille or screen in accordance with NFPA 90A.

2.9.5.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with antismudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller.

2.9.5.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply registers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Return and exhaust registers shall be located 6 inches above the floor unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.9.6 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.10 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123 or ASTM A 653 shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned,

phosphated and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint in accordance with ASTM D 520, Type I.

PART 3 EXECUTION

3.1 INSTALLATION

The warm air heating installation shall conform to the requirements contained in NFPA 90A or NFPA 90B, as applicable. Combustion air supply and ventilation shall be in accordance with NFPA 31 or NFPA 54.

3.1 Furnaces

Foundations, settings, or suspensions for mounting equipment and accessories including supports, vibration isolators, stands, guides, anchors, clamps, and brackets shall be provided. Foundations and suspension for equipment shall conform to the recommendations of the manufacturer, unless otherwise indicated on drawings. Anchor bolts and sleeves shall be set accurately using properly constructed templates. Anchor bolts, when embedded in concrete, shall be provided with welded-on plates on the head end and guarded against damage until equipment is installed. Equipment bases shall be leveled, using jacks or steel wedges, and when resting on concrete shall be neatly grouted-in with a nonshrinking type of grout. Equipment shall be located as indicated and in such a manner that working space is available for all necessary servicing, such as shaft removal, replacing, or adjusting drives, motors, or shaft seals, air filters, access to automatic controls, humidifiers, and lubrication. Electrical isolation shall be provided between dissimilar metals for the purpose of minimizing galvanic corrosion. The interior of cabinets or casings shall be cleaned before completion of installation. The furnace shall be connected to the vent or chimney with the specified connectors, draft regulators, draft loads, and induced draft fans, as applicable, in accordance with NFPA 211.

3.2 Gas Fired and Electric Unit Heaters

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators. Locate equipment in such a manner that working space is available for servicing, such as vacuum pump and burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.3 Access Panels

Access panels shall be provided for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance. Access panels shall be of sufficient size and so located that the concealed items may be serviced and maintained or completely removed for replacement. Access

panels shall be as specified in Section 05500 MISCELLANEOUS METAL.

3.4 Flexible Connectors

Pre-insulated flexible connectors and flexible duct shall be attached to other components in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint.

3.5 Metal Ductwork

Installation shall be in accordance with SMACNA-06 unless otherwise indicated. Duct supports for sheet metal ductwork shall be in accordance with SMACNA-06, unless otherwise specified. Friction beam clamps indicated in SMACNA-06 shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.6 Air Filters

Air filters shall be installed in return air grilles. Fans or blowers shall not be operated until filters are installed. After completion of tests and before the building is accepted by the Government, the Contractor shall furnish a new second set of replaceable filters, where utilized.

3.7 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.8 Insulation

Thickness and application of insulation materials for ductwork and equipment shall be in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.1.12 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.2 FIELD PAINTING

Finish painting of items only primed at the factory or surfaces not specifically noted, otherwise are specified in Section 09900 PAINTING, GENERAL.

3.9 CLEANING

Ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. All equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.10 TESTS

Upon completion and prior to acceptance of the installation, the Contractor shall furnish all equipment, instruments, materials, labor, and supervision required for the tests as specified. Water, electricity, and fuel required for testing will be furnished by the Government. Defects disclosed by the tests shall be rectified. Tests shall be made under the direction and subject to the approval of the Contracting Officer. All indicating instruments shall be read at 1/2-hour intervals unless otherwise directed by the Contracting Officer.

3.10.1 Testing, Adjusting, and Balancing

Testing, adjusting, and balancing shall be as specified in SECTION 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.10.2 Performance Tests

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be conducted by an experienced engineer. Tests shall cover a period of not less than 2 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity in a shaded and weather protected area.

3.11 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 8 hours of normal working time shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved operating and maintenance instructions.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15653

AIR-CONDITIONING SYSTEM (UNITARY TYPE)

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE, AND HANDLING
- 1.4 PROJECT/SITE CONDITIONS
 - 1.4.1 Verification of Dimensions
 - 1.4.2 Drawings

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 NAMEPLATES
- 2.3 ELECTRICAL WORK
- 2.4 MISCELLANEOUS MATERIALS
- 2.5 UNITARY EQUIPMENT, ROOM UNIT
 - 2.5.1 Packaged Terminal Unit
 - 2.5.2 Compressor
 - 2.5.3 Air-To-Refrigerant Coils
 - 2.5.4 Fans
 - 2.5.5 Air Filters
 - 2.5.6 Supplemental Heat
 - 2.5.7 Cabinet Construction
 - 2.5.8 Wall Sleeve
 - 2.5.9 Unit Controls
- 2.6 EQUIPMENT EFFICIENCY
- 2.7 SYSTEM COMPONENTS
 - 2.7.1 Refrigerant and Oil
 - 2.7.2 Supplemental Heating
 - 2.7.2.1 Electric Heating Coil
- 2.8 FABRICATION
 - 2.8.1 Factory Coating

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Equipment
 - 3.1.2 Factory Applied Insulation
- 3.2 TESTS
 - 3.2.1.1 Contractor's Responsibility
- 3.3 CLEANING AND ADJUSTING
 - 3.3.1 Equipment
 - 3.3.2 Testing, Adjusting, and Balancing
- 3.4 DEMONSTRATIONS

-- End of Section Table of Contents --

SECTION 15653

AIR-CONDITIONING SYSTEM (UNITARY TYPE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

- | | |
|-------------|---|
| ARI 310/380 | (1993) Packaged Terminal Air-Conditioners |
| ARI 350 | (1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment |
| ARI 700 | (1993) Specifications for Fluorocarbon and Other Refrigerants |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|--|
| ASTM B 117 | (1994) Operating Salt Spray (Fog) Testing Apparatus |
| ASTM E 437 | (1992) Industrial Wire Cloth and Screens (Square Opening Series) |

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- | | |
|-----------|---|
| ASHRAE 15 | (1994) Safety Code for Mechanical Refrigeration |
| ASHRAE 34 | (1994) Number Designation and Safety Classification of Refrigerants |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|---|
| NEMA MG 2 | (1989; Rev 1) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators |
|-----------|---|

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- | | |
|----------|---|
| NFPA 90A | (1993) Installation of Air Conditioning and Ventilating Systems |
|----------|---|

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Air-Conditioning/Heat Pump System; GA.

Manufacturer's standard catalog data, prior to the purchase or installation of a particular component, shall be highlighted to show brand name, model number, size, options, performance charts and curves, etc. in sufficient detail to demonstrate compliance with contract requirements. Data shall be submitted for each specified component. Data shall include manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Spare Parts Data; FIO.

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

SD-06 Instructions

Framed Instructions; FIO.

Framed instructions for posting, at least 2 weeks prior to construction completion.

SD-07 Schedules

Tests; FIO.

A letter, at least 10 working days in advance of each tests, advising the Contracting Officer of the test. Letters shall be submitted for the system performance tests. Each letter shall identify the date, time, and location for each test.

Demonstrations; GA.

A letter, at least 14 working days prior to the date of the proposed training course, which identifies the date, time, and location for the training.

SD-08 Statements

Verification of Dimensions; FIO.

A letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

SD-09 Reports

System Performance Tests; GA.

Six copies of the report shall be provided in bound 8-1/2 by 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

- (1) Date and outside weather conditions.
- (2) The load on the system based on the following:
 - (a) The refrigerant used in the system.
 - (b) Condensing temperature and pressure.
 - (c) Suction temperature and pressure.
 - (d) Ambient, condensing and coolant temperatures
 - (e) Running current, voltage and proper phase sequence for each phase of all motors.
- (3) The actual on-site setting of operating and safety controls.
- (4) Thermostatic expansion valve superheat - value as determined by field test
- (5) Subcooling
- (6) High and low refrigerant temperature switch set-points
- (7) Low oil pressure switch set-point
- (8) Defrost system timer and thermostat set-points
- (9) Moisture content
- (10) Capacity control set-points
- (11) Field data and adjustments which affect unit performance and energy consumption.
- (12) Field adjustments and settings which were not permanently marked as an integral part of a device.

SD-13 Certificates

Air-Conditioning/Heat Pump System; GA.

Where the system, components, or equipment are specified to comply with requirements of ARI, ASHRAE, ASME, or UL, proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a

current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

Service Organizations; GA.

A certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

SD-19 Operation and Maintenance Manuals

Operation Manual; FIO.

Six complete copies of an operation manual in bound 8-1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, and shutdown. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

Maintenance Manual; FIO.

Six complete copies of maintenance manual in bound 8-1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.4 PROJECT/SITE CONDITIONS

1.4.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.4.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions. Equipment, ductwork, and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry,

servicing, and maintenance.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be environmentally suitable for the indicated locations.

2.2 NAMEPLATES

Major equipment including compressors, condensers, receivers, heat exchanges, fans, cooling towers, pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of anodized aluminum or stainless steel. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 MISCELLANEOUS MATERIALS

</2.4.8 Bird Screen

Screen shall be in accordance with ASTM E 437, Type 1, Class 1, 2 by 2 mesh, 0.063 inch diameter aluminum wire or 0.031 inch diameter stainless steel wire.

2.5 UNITARY EQUIPMENT, ROOM UNIT

2.5.1 Packaged Terminal Unit

Unit shall be a through-the-wall mounted, heavy-duty commercial grade, factory assembled and precharged heat pump unit. Unit shall be in accordance with ARI 310/380 and UL 1995. Units shall be removable from inside the building for servicing without removing the outside cabinet. Unit shall have a noise rating in accordance with ARI 350 and not exceed 95 bels while the entire unit is operating at any fan or compressor speed. Heat pump units shall contain a reversing valve to change unit to heating cycle. An outdoor coil temperature sensor shall be provided to guard against coil freeze-up by either switching to supplemental heat only, or by cycling the compressor to defrost the coil.

2.5.2 Compressor

Compressor shall be hermetically sealed reciprocating, rotary, or scroll type. Compressor shall be fitted with permanent split capacitor motor, overload protection, and vibration isolators. Compressor shall be protected against high discharge pressure, loss of charge, low voltage, and short cycling.

2.5.3 Air-To-Refrigerant Coils

Evaporator and condenser coils shall have nonferrous tubes of 3/8 inch minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. A condensate removal system shall be provided.

2.5.4 Fans

Indoor and outdoor fans shall be the centrifugal, direct driven type. Fans shall be statically and dynamically balanced. Outdoor fan shall be designed so that condensate will evaporate without drip, splash, or spray on building exterior. Indoor fan shall be provided with a minimum two-speed motor with built-in overload protection. Fan motors shall be the inherently protected, permanent split-capacitor type.

2.5.5 Air Filters

Filters shall be of the sectional or panel cleanable type and be capable of filtering the entire air supply.

2.5.6 Supplemental Heat

Supplemental heat shall be provided as specified in paragraph "System Components".

2.5.7 Cabinet Construction

Cabinet shall be free of visible fasteners, sharp protuberances and edges. Enclosure sheet metal shall be a minimum of 18 gauge steel with a protective coating. Face panels shall be removable and shall provide full access to unit appurtenances. Access to controls shall be without removal of the face panel. Conditioned air shall discharge through adjustable louvers. Cabinet shall be thermally and acoustically insulated with materials which conform to NFPA 90A. Units shall be furnished with a field-wired subbase. Subbase shall have leveling screws without provisions for remote unit control. Subbase shall be of 18 gauge galvanized steel construction with a protective coating to match that of the room cabinet. Paint and finishes shall comply with the requirements specified in paragraph "Factory Coating".

2.5.8 Wall Sleeve

Louver shall be stormproof type, constructed of anodized, stamped or extruded aluminum. Sleeve shall be a water and airtight noninsulated assembly, with weather-resistant protective coating.

2.5.9 Unit Controls

Controls shall include an on-off switch, high and low selector switch for both the heating and cooling mode, multiple speed fan cooling and heating mode, room air fan switch, outside air damper control, and an adjustable cooling and heating thermostat. Function and temperature controls shall be integral to unit.

2.6 EQUIPMENT EFFICIENCY

Unit shall have an efficiency as indicated on the drawings.

2.7 SYSTEM COMPONENTS

2.7.1 Refrigerant and Oil

Refrigerant shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ASHRAE 34. Refrigerants shall meet the requirements of ARI 700 as a minimum. Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05. Contractor shall provide and install a complete charge of refrigerant for the installed system as recommended by the manufacturer. Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase shall be furnished. One charge shall be used during the system performance testing period. Following the satisfactory completion of the performance testing, the oil shall be drained and replaced with a second charge. Lubricating oil shall be of a type and grade recommended by the manufacturer for each compressor. Where color leak indicator dye is incorporated, charge shall be in accordance with manufacturer's recommendation.

2.7.2 Supplemental Heating

2.7.2.1 Electric Heating Coil

Coil shall be unit-mounted. Coil shall be of the nickel chromium resistor, single stage, strip or nickel chromium resistor, single stage, strip or stainless steel, fin tubular type. Coil shall be provided with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Coil casing and support brackets shall be of galvanized steel or aluminum. Coil shall be mounted to eliminate noise from expansion and contraction and be completely accessible for service.

2.8 FABRICATION

2.8.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 125 hours exposure to the salt spray test specified in ASTM B 117 using a 25 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements.

3.1.1 Equipment

Refrigeration equipment and the installation thereof shall conform to ASHRAE 15. Necessary supports shall be provided for all equipment and appurtenances as required, including frames or supports. Compressors shall be isolated from the building structure. If mechanical vibration isolators are not provided, vibration absorbing foundations shall be provided.

3.1.2 Factory Applied Insulation

Refrigerant suction lines between an evaporator and compressors shall be insulated with not less than 3/4 inch thick unicellular plastic foam.

3.2 TESTS

Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government.

Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 15990 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.2.1.1 Contractor's Responsibility

The Contractor shall, at all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants

into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim.

At no time shall more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

3.3 CLEANING AND ADJUSTING

3.3.1 Equipment

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.3.2 Testing, Adjusting, and Balancing

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS.

3.4 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field instructions shall cover all of the items contained in the operation and maintenance manuals as well as demonstrations of routine maintenance operations.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 COORDINATION OF TRADE
- 1.3 DELIVERY AND STORAGE
- 1.4 SUBMITTALS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 ASBESTOS PROHIBITION
- 2.3 NAMEPLATES
- 2.4 EQUIPMENT GUARDS AND ACCESS
- 2.5 ELECTRICAL WORK
- 2.6 CONTROLS
- 2.7 DUCTWORK COMPONENTS
- 2.8 AIR SYSTEMS EQUIPMENT
 - 2.8.1 Fans
 - 2.8.1.1 Centrifugal Type Power Roof Ventilators

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Power Roof Ventilator Mounting
 - 3.1.2 Power Transmission Components Adjustment
- 3.2 CLEANING AND ADJUSTING
- 3.3 TESTING, ADJUSTING, AND BALANCING
- 3.4 PERFORMANCE TESTS

-- End of Section Table of Contents --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI Guideline D (1987) Application and Installation of
Central Station Air-Handling Units

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 210 (1985) Laboratory Methods of Testing Fans
for Rating

AMCA 300 (1996) Reverberant Room Method for Sound
Testing of Fans

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1993; Rev 1; Rev 2) Motors and Generators

1.2 COORDINATION OF TRADE

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Components and Equipment Data; GA

Manufacturer's catalog data shall be included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate

to demonstrate compliance with contract requirements for the following:

c. Air Systems Equipment

SD-19 Operation and Maintenance Manuals

Air Supply, Distribution, Ventilation, and Exhaust Manuals; GA

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified.

2.5 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric

equipment, including wiring and motor efficiencies, shall be according to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

2.6 CONTROLS

Controls shall be provided as specified in Section 15950 HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

2.7 DUCTWORK COMPONENTS

Ductwork and accessories shall be as specified in Section 15566 WARM AIR HEATING SYSTEMS.

2.8 AIR SYSTEMS EQUIPMENT

2.8.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 120 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts.

Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.8.1.1 Centrifugal Type Power Roof Ventilators

Fans shall be direct or V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided with birdscreen, disconnect switch, gravity dampers, and

roof curb. Motors enclosure shall be dripproof type.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Power Roof Ventilator Mounting

Foamed 1/2 inch thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used, holes shall be pre-drilled for fasteners.

3.1.2 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 CLEANING AND ADJUSTING

Inside of fans, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.3 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.4 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 1 day for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15950

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Verification of Dimensions
 - 1.2.2 Drawings
- 1.3 SUBMITTALS
- 1.4 DELIVERY AND STORAGE
- 1.5 OPERATION MANUAL
- 1.6 MAINTENANCE AND REPAIR MANUAL

PART 2 PRODUCTS

- 2.1 MATERIAL AND EQUIPMENT
- 2.2 GENERAL EQUIPMENT REQUIREMENTS
 - 2.2.1 Electrical and Electronic Devices
 - 2.2.2 Ambient Temperature Limits
- 2.3 MATERIALS
 - 2.3.1 Wiring
 - 2.3.1.1 Terminal Blocks
 - 2.3.1.2 Control Wiring for 24-Volt Circuits
 - 2.3.1.3 Wiring for 120-Volt Circuits
- 2.4 ACTUATORS
- 2.5 DAMPERS
 - 2.5.1 Damper Assembly
 - 2.5.1.1 Operating Links
 - 2.5.1.2 Damper Types
 - 2.5.2 Outside-Air, Return-Air, and Relief-Air Dampers
- 2.6 THERMOSTATS
 - 2.6.1 Nonmodulating Room Thermostats
- 2.7 CONTROL DEVICES AND ACCESSORIES
 - 2.7.1 Relays

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION CRITERIA
 - 3.1.1 Device Mounting Criteria
 - 3.1.2 Wiring Criteria
 - 3.1.2.1 Power-Line Surge Protection
 - 3.1.2.2 Surge Protection for Transmitter and Control Wiring
 - 3.1.2.3 Controller Output Loop Impedance Limitation
- 3.2 CONTROL SYSTEM INSTALLATION
 - 3.2.1 Damper Actuators
- 3.3 CONTROL SEQUENCES OF OPERATION
- 3.4 COMMISSIONING PROCEDURES
 - 3.4.1 General Procedures

- 3.4.1.1 Evaluations
- 3.4.2 Heating and Ventilating
- 3.5 BALANCING, COMMISSIONING, AND TESTING
 - 3.5.1 Coordination with HVAC System Balancing
 - 3.5.2 Control System Calibration, Adjustments, and Commissioning
 - 3.5.3 Performance Verification Test
 - 3.5.4 Posted and Panel Instructions
- 3.6 TRAINING
 - 3.6.1 Training-Course Requirements
 - 3.6.2 Training-Course Content

-- End of Section Table of Contents --

SECTION 15950
HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500 (1989) Test Methods for Louvers, Dampers
and Shutters

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC
Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment
(1000 Volts Maximum)

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment Compliance Booklet; GA

An HVAC control system equipment compliance booklet (ECB) in indexed

booklet form with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a bill of materials for each HVAC control system. The bill of materials shall function as the table of contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB.

SD-04 Drawings

HVAC Control System; GA

Drawings on A1 34 by 22 inch sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and device identifiers shown. Each control-system element on a drawing shall have a unique identifier as shown. All HVAC control system drawings shall be delivered together as a complete submittal. Drawings shall be submitted for each HVAC system.

- a. HVAC control system drawings shall include the following:

Sheet One: Drawing index, HVAC control system legend.

Sheet Two: Valve schedule, damper schedule.

Sheet Three: Compressed air station schematic.

Sheet Four: HVAC control system schematic and equipment schedule.

Sheet Five: HVAC control system sequence of operation and ladder diagram.

Sheet Six: HVAC control panel arrangement, control panel cross-section, and control panel inner door layout.

Sheet Seven: HVAC control panel back-panel layout.

Sheet Eight: Control loop wiring diagrams.

Sheet Nine: Motor starter and relay wiring diagram.

Note: Repeat sheets four through nine for each AHU system.

- b. An HVAC control system drawing index showing the name and number of the building, military site, State or other similar designation, and Country. The drawing index shall list all HVAC control system drawings, including the drawing number, sheet number, drawing title, and computer filename when used.
- c. An HVAC control system legend showing generic symbols and the name of devices shown on the HVAC control system drawings.
- d. A valve schedule showing each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off

pressure data, dimensions, and access and clearance requirements data.

- e. A damper schedule showing each damper and actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The damper schedule shall include the maximum leakage rate at the operating static-pressure differential. The damper schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements.
- f. A compressed-air station schematic diagram showing all equipment, including: compressor with motor horsepower and voltage; starter; isolators; manual bypasses; tubing sizes; drain piping and drain traps; reducing valves; dryer; and data on manufacturer's names and model numbers, mounting, access, and clearance requirements. Air compressor and air dryer data shall include calculations of the air consumption of current-to-pneumatic transducers and any other control system devices to be connected to the compressed air station, and the compressed air supply dewpoint temperature at 20 psig.
- g. An HVAC control system equipment schedule showing the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e. output range).
- h. An HVAC control system sequence of operation.
- I. An HVAC control system ladder diagram showing all relays, contacts, pilot lights, switches, fuses and starters connected to the control system.
- j. HVAC control panel arrangement drawings showing both side and front views of the panel. The drawing shall show panel and mounting dimensions.
- k. HVAC control panel cross-section drawings showing mounting rails and standoffs for devices.
- l. HVAC control panel inner door layout drawings showing both front and rear views of the inner door. The drawings shall show device locations, labels, nameplate legends, and fabrication details.
- m. HVAC control panel back-panel layout drawings showing device locations, labels, nameplate legends, terminal block layout, fabrication details, and enclosure operating temperature-rise calculations.
- n. HVAC control system wiring diagrams showing functional wiring diagrams of the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show all necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for

packaged-equipment control systems shall be identified back to the panel-board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

SD-08 Statements

Commissioning Procedures; GA

- a. Six copies of the HVAC control system commissioning procedures, in indexed booklet form, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal-unit control system. The commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as shown. The commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.
- b. Commissioning procedures documenting detailed, product-specific set-up procedures, configuration procedures, adjustment procedures, and calibration procedures for each device. Where the detailed product-specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.
- c. Commissioning procedures documenting controller configuration check sheets for each controller listing all configuration parameters, dip switch and jumper settings, and initial recommended P, I and D values. The configuration parameters shall be listed in the order in which they appear during the configuration process. Each configuration parameter shall be noted as being: set per specs with no field adjustment required, set per specs but field adjustable, or not applicable.
- d. Commissioning procedures showing a time clock configuration check sheet listing all parameters, and switch settings. The parameters shall be listed in the order which they appear during the setup process.
- e. An HVAC control system commissioning procedures equipment list that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Test Procedures; GA

Six copies of the HVAC control system performance verification test procedures, in indexed booklet form, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during

performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Training Course Materials; GA

Six copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course. An HVAC control system training course, in outline form, with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least 60 days prior to the start of the training.

SD-09 Reports

Commissioning Report; GA

Six copies of the HVAC control system commissioning report, in indexed booklet form, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning and shall follow the format of the commissioning procedures. The commissioning report shall include all controller and time clock checksheets with final values listed for all parameters, setpoints, P, I, D setting constants, calibration data for all devices, and results of adjustments.

Performance Verification Test Report; GA

Six copies of the HVAC control system performance verification test report, in indexed booklet form, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of data gathered during the performance verification test shall be turned over to the Government after Government approval of the test results.

SD-13 Certificates

ASME Air-Storage Tank Certificate; GA

An ASME Air-Storage Tank Certificate for each storage tank.

SD-18 Records

Service Organizations; GA

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

SD-19 Operation and Maintenance Manuals

Operation Manual; GA

Maintenance and Repair Manual; GA

Six copies of the HVAC control system operation manual and HVAC control

system maintenance and repair manual for each HVAC control system 30 days before the date scheduled for the training course.

1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

1.5 OPERATION MANUAL

An HVAC control system operation manual for each HVAC control system, in indexed booklet form, shall be provided. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built controller configuration checksheets, the as-built time clock configuration checksheet, the HVAC control system front panel description, the procedures for changing HVAC system controller setpoints, the procedures for gaining manual control of processes, the time clock manufacturer's manual control of processes, the time clock manufacturer's operation manual, and the controller manufacturer's operation manual.

- a. The HVAC control system front panel description shall explain the meaning and use of the lights, switches, gauges, and controller displays located in the front panel. Each light, switch, gauge, and display described shall be numbered and referenced to a drawing of the front panel.
- b. The procedures for changing HVAC system controller setpoints shall describe the step-by-step procedures required to change: the process variable setpoints of controllers, the alarm setpoints of controllers, the controller bias settings, and controller setpoint reset schedules.
- c. The procedures for gaining manual control of processes shall describe step-by-step procedures required to gain manual control of devices and manually adjust their positions.

1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual for each HVAC control system, in indexed booklet form in hardback binders, shall be provided. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet (EDB).

- a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet (ECB), the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or

reference.

- b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment compliance booklet (ECB) and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.
- c. The as-built equipment data booklet (EDB) shall include the equipment compliance booklet (ECB) and all manufacturer supplied user manuals and information.
- d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations and qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period.

2.2 GENERAL EQUIPMENT REQUIREMENTS

2.2.1 Electrical and Electronic Devices

All electrical, electronic, and electro-pneumatic devices not located within an HVAC control panel shall have a NEMA Type 1 enclosure in accordance with NEMA 250 unless otherwise shown.

2.2.2 Ambient Temperature Limits

Ambient Temperature Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of 40 to 140 degrees F. All panel-mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10 percent to 95 percent relative humidity, noncondensing. All devices installed outdoors shall operate within limit ratings of minus 40 to plus 150 degrees F.

2.3 MATERIALS

2.3.1 Wiring

2.3.1.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.3.1.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

2.3.1.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

2.4 ACTUATORS

Actuators shall be provided with mounting and connecting hardware. Actuators shall fail to their spring-return positions on signal or power failure. The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. Electric or electronic actuators operating in series shall have an auxiliary actuator driver. Electric actuators shall have an oil-immersed gear train. Electric actuators used in a sequencing application shall have zero and span adjustments.

2.5 DAMPERS

2.5.1 Damper Assembly

A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 0.5 inch (minimum) plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with AMCA 500.

2.5.1.1 Operating Links

Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2.5.1.2 Damper Types

Dampers shall be parallel blade type.

2.5.2 Outside-Air, Return-Air, and Relief-Air Dampers

The dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 to plus 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity.

2.6 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electronic or electric.

2.6.1 Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F. Room thermostats shall be enclosed with separate locking covers (guards). Thermostats shall have manual switches as required by the application.

2.7 CONTROL DEVICES AND ACCESSORIES

Except where otherwise specified control device and accessory input impedance shall not exceed 250 ohms.

2.7.1 Relays

Relays shall be 2-pole, double-throw (2PDT) with a 10-ampere resistive rating at 120 Vac, and shall have an enclosed 120-Vac coil with 8 pin blade connectors, and a matching rail-mounted socket. Power consumption shall not be greater than 3 watts.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

The HVAC control system shall be installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.1 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in

mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

3.1.2 Wiring Criteria

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. Wiring shall be installed without splices between control devices and HVAC control panels. Cables and conductors shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown.

3.1.2.1 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from powerline surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

3.1.2.2 Surge Protection for Transmitter and Control Wiring

HVAC system control panel equipment shall be protected against surges induced on control and transmitter wiring installed outside and as shown. The equipment protection shall be tested in the normal mode and in the common mode, using the following two waveforms:

- a. A 10-microsecond by 1000-microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8-microsecond by 20-microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

3.1.2.3 Controller Output Loop Impedance Limitation

Controller output loops shall be constructed so that total circuit impedance connected to the analog output of a single-loop controller shall not exceed 600 ohms.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.3 CONTROL SEQUENCES OF OPERATION

Sequence of operation shall be as indicated on the drawings.

3.4 COMMISSIONING PROCEDURES

3.4.1 General Procedures

3.4.1.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the timeclock schedule, and make any necessary control-system corrections to ensure that the systems function as described in paragraph CONTROL SEQUENCES OF OPERATION. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.

3.4.2 Heating and Ventilating

Steps for installation are as follows:

- a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air damper and relief-air damper shall be closed and the return-air damper shall be open.
- b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for space temperature shall be checked.
- c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma or 3 psig to 20 ma or 15 psig, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.
- d. Step 4 - Control-System Commissioning:
 - (1) With the fan ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay-mode pilot light turns on. The occupied-mode signal shall be applied and it shall be verified that the occupied-mode pilot light turns on and that supply fan starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the heating-coil valve is under control, by slightly changing the controller outputs. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air, and relief-air dampers come under control by changing the controller output.
 - (2) The minimum-outside-air-mode signal shall be applied. It

shall be verified that the outside-air damper opens to minimum position and the economizer pilot light is off.

(3) The space-temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the calibration accuracy check for sensing element-to-controller readout shall be performed. The controller shall be placed in the remote-setpoint mode. The setpoint low-end limit shall be set to 66 degrees F and the high-end limit shall be set to 72 degrees F. Proper operation of the temperature setpoint device at the space temperature sensing element and transmitter location shall be verified. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position and the controller-tuning procedure shall be performed. The temperature setpoint device shall be set to the space temperature setpoint as shown.

(4) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

(5) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated, at the device. It shall be verified that the filter pilot light turns on, and that contact output at EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

(6) With the HVAC system running, a freezestat trip input signal shall be simulated, at the device. HVAC system shutdown shall be observed. It shall be verified that the low-temperature pilot light turns on and that contact output at the EMCS terminals is made. The freezestat shall be set at the setpoint as shown. The HVAC shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

(7) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and verification of control-device actions and interlock functions as described in paragraph CONTROL SEQUENCES OF OPERATION shall be made. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at EMCS terminals shall be verified. The detectors shall be reset. The HVAC system shall be restarted by manual reset, and it shall be verified that the pilot light turns off.

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to or simultaneous with HVAC system balancing. The Contractor shall tune the HVAC control system after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report has been issued.

3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Written notification of any planned commissioning or testing of the HVAC Control systems shall be given to the Government at least 14 calendar days in advance.

3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the commissioning report and completion of balancing. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems.

3.5.4 Posted and Panel Instructions

Posted and panel instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of half-size laminated drawings and shall include the control system schematic, equipment schedule, ladder diagram, sequence of operation, panel arrangement drawings, wiring diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a routine maintenance checklist and controller configuration check sheets with final configuration record for each controller. Panel instructions and one copy of the operation and maintenance manuals, previously described herein, shall be placed inside each control panel.

3.6 TRAINING

3.6.1 Training-Course Requirements

A training course shall be conducted for operating staff members designated by the Contracting Officer. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and 6 sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks

and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.6.2 Training-Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the operating and maintenance instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, the location of the compressed-air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 SIMILAR TERMS
- 1.4 TAB STANDARD
- 1.5 QUALIFICATIONS
 - 1.5.1 TAB Firm
 - 1.5.2 TAB Specialist
- 1.6 TAB SPECIALIST RESPONSIBILITIES

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 DESIGN REVIEW
- 3.2 TAB RELATED HVAC SUBMITTALS
- 3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS
- 3.4 TESTING, ADJUSTING, AND BALANCING
 - 3.4.1 TAB Procedures
 - 3.4.2 Systems Readiness Check
 - 3.4.3 Preparation of TAB Report
 - 3.4.4 TAB Verification
 - 3.4.5 Marking of Setting
 - 3.4.6 Identification of Test Ports

-- End of Section Table of Contents --

SECTION 15990

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (1989) National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB-01 (1991) Procedural Standards for Testing Adjusting Balancing of Environmental Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

TAB Related HVAC Submittals; FIO.

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB Specialist.

SD-04 Drawings

TAB Schematic Drawings and Report Forms; GA.

Three copies of the TAB Schematic Drawings and Report Forms, no later than 21 days prior to the start of TAB field measurements.

SD-06 Instructions

TAB Procedures; GA.

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

SD-07 Schedules

Systems Readiness Check; FIO.

Proposed date and time to begin the Systems Readiness Check, no later than 7 days prior to the start of the Systems Readiness Check.

TAB Execution; GA .

Proposed date and time to begin field measurements, making adjustments, etc., for the TAB Report, submitted with the Systems Readiness Check Report.

TAB Verification; GA.

Proposed date and time to begin the TAB Verification, submitted with the TAB Report.

SD-08 Statements

TAB Firm; GA.

Certification of the proposed TAB Firm's qualifications by either AABC or NEBB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Firm or disciplinary action taken by AABC or NEBB against the proposed TAB Firm shall be described in detail.

TAB Specialist; GA.

Certification of the proposed TAB Specialist's qualifications by either AABC or NEBB to perform the duties specified herein and in other related Sections, no later than 21 days after the Notice to Proceed. The documentation shall include the date that the Certification was initially granted and the date that the current Certification expires. Any lapses in Certification of the proposed TAB Specialist or disciplinary action taken by AABC or NEBB against the proposed TAB Specialist shall be described in detail.

Instrument Calibration; FIO.

List of each instrument to be used during TAB, stating calibration requirements required or recommended by both the TAB Standard and the instrument manufacturer and the actual calibration history of the instrument, submitted with the TAB Procedures. The calibration history shall include dates calibrated, the qualifications of the calibration laboratory, and the calibration procedures used.

SD-09 Reports

Design Review Report; GA.

A copy of the Design Review Report, no later than 14 days after approval of the TAB Firm and the TAB Specialist.

Systems Readiness Check Report; GA.

A copy of completed checklists for each system, each signed by the TAB Specialist, at least 7 days prior to the start of TAB Execution. All items in the Systems Readiness Check Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association

used as the TAB Standard.

TAB Report; GA.

Three copies of the completed TAB Reports, no later than 7 days after the execution of TAB. All items in the TAB Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

TAB Verification Report; GA.

Three copies of the completed TAB Verification Report, no later than 7 days after the execution of TAB Verification. All items in the TAB Verification Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

SD-13 Certificates

Ductwork Leak Testing; FIO.

A written statement signed by the TAB Specialist certifying that the TAB Specialist witnessed the Ductwork Leak Testing, it was successfully completed, and that there are no known deficiencies related to the ductwork installation that will prevent TAB from producing satisfactory results.

1.3 SIMILAR TERMS

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC or NEBB requirements where differences exist.

SIMILAR TERMS

| Contract Term | AABC Term | NEBB Term |
|-------------------------|---|--|
| TAB Standard | National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems | Procedural Standards for Testing Adjusting Balancing of Environmental Systems. |
| TAB Specialist | TAB Engineer | TAB Supervisor |
| Systems Readiness Check | Construction Phase Inspection | Field Readiness Check & Preliminary Field Procedures. |

1.4 TAB STANDARD

TAB shall be performed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1 or NEBB-01, unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc., shall, as nearly as practical, be used to satisfy the

Contract requirements. The TAB Standard shall be used for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, the manufacturer's recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC or NEBB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

1.5 QUALIFICATIONS

1.5.1 TAB Firm

The TAB Firm shall be either a member of AABC or certified by the NEBB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems and the measuring of sound and vibration in environmental systems. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor.

1.5.2 TAB Specialist

The TAB Specialist shall be either a member of AABC or an experienced technician of the Firm certified by the NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

1.6 TAB SPECIALIST RESPONSIBILITIES

All TAB work specified herein and in related sections shall be performed under the direct guidance of the TAB Specialist.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 DESIGN REVIEW

The TAB Specialist shall review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.2 TAB RELATED HVAC SUBMITTALS

The TAB Specialist shall prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the TAB Specialist when submitted to the Government. The TAB Specialist shall also ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

A schematic drawing showing each system component, including balancing devices, shall be provided for each system. Each drawing shall be accompanied by a copy of all report forms required by the TAB Standard used for that system. Where applicable, the acceptable range of operation or appropriate setting for each component shall be included on the forms or as an attachment to the forms. The schematic drawings shall identify all testing points and cross reference these points to the report forms and procedures.

3.4 TESTING, ADJUSTING, AND BALANCING

3.4.1 TAB Procedures

Step by step procedures for each measurement required during TAB Execution shall be provided. The procedures shall be oriented such that there is a separate section for each system. The procedures shall include measures to ensure that each system performs as specified in all operating modes, interactions with other components (such as exhaust fans, kitchen hoods, fume hoods, relief vents, etc.) and systems, and with all seasonal operating differences, diversity, simulated loads, and pressure relationships required.

3.4.2 Systems Readiness Check

The TAB Specialist shall inspect each system to ensure that it is complete, including installation and operation of controls, and that all aspects of the facility that have any bearing on the HVAC systems, including installation of ceilings, walls, windows, doors, and partitions, are complete to the extent that TAB results will not be affected by any detail or touch-up work remaining. The TAB Specialist shall also verify that all items such as ductwork and piping ports, terminals, connections, etc., necessary to perform TAB shall be complete during the Systems Readiness Check.

3.4.3 Preparation of TAB Report

Preparation of the TAB Report shall begin only when the Systems Readiness

Report has been approved. The Report shall be oriented so that there is a separate section for each system. The Report shall include a copy of the appropriate approved Schematic Drawings and TAB Related Submittals, such as pump curves, fan curves, etc., along with the completed report forms for each system. The operating points measured during successful TAB Execution and the theoretical operating points listed in the approved submittals shall be marked on the performance curves and tables. Where possible, adjustments shall be made using an "industry standard" technique which would result in the greatest energy savings, such as adjusting the speed of a fan instead of throttling the flow. Any deficiencies outside of the realm of normal adjustments and balancing during TAB Execution shall be noted along with a description of corrective action performed to bring the measurement into the specified range. If, for any reason, the TAB Specialist determines during TAB Execution that any Contract requirement cannot be met, the TAB Specialist shall immediately provide a written description of the deficiency and the corresponding proposed corrective action necessary for proper system operation to the Contracting Officer.

3.4.4 TAB Verification

The TAB Specialist shall recheck ten percent of the measurements listed in the Tab Report and prepare a TAB Verification Report. The measurements selected for verification and the individuals that witness the verification will be selected by the Contracting Officer's Representative (COR). The measurements will be recorded in the same manner as required for the TAB Report. All measurements that fall outside the acceptable operating range specified shall be accompanied by an explanation as to why the measurement does not correlate with that listed in the TAB Report and a description of corrective action performed to bring the measurement into the specified range. If over 20 percent of the measurements selected by the COR for verification fall outside of the acceptable operating range specified, the COR will select an additional ten percent for verification. If over 20 percent of the total tested (including both test groups) fall outside of the acceptable range, the TAB Report shall be considered invalid and all contract TAB work shall be repeated beginning with the Systems Readiness Check.

3.4.5 Marking of Setting

Following approval of TAB Verification Report, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time.

3.4.6 Identification of Test Ports

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leakage or to maintain integrity of vapor barrier.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16370

ELECTRICAL DISTRIBUTION SYSTEM, AERIAL

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Terminology
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 EXTRA MATERIALS

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
- 2.2 STANDARD PRODUCT
- 2.3 NAMEPLATES
 - 2.3.1 General
- 2.4 CORROSION PROTECTION
 - 2.4.1 Aluminum Materials
 - 2.4.2 Ferrous Metal Materials
 - 2.4.2.1 Hardware
 - 2.4.2.2 Equipment
 - 2.4.3 Finishing
- 2.5 CONDUCTORS, CONNECTORS, AND SPLICES
 - 2.5.1 Aluminum-Composition Conductors
 - 2.5.2 Copper Conductors
 - 2.5.3 Connectors and Splices
- 2.6 POLES AND HARDWARE
 - 2.6.1 Wood Poles
 - 2.6.2 Pole Line Hardware
 - 2.6.3 Armless Construction
 - 2.6.4 Guy Assemblies
- 2.7 INSULATORS
 - 2.7.1 Medium-Voltage Line Insulators
 - 2.7.2 Low-Voltage Line Insulators
 - 2.7.3 Apparatus Insulators
- 2.8 FUSES AND SWITCHES, MEDIUM-VOLTAGE
 - 2.8.1 Fuse Cutouts
- 2.9 SURGE ARRESTERS
- 2.10 GROUNDING AND BONDING
 - 2.10.1 Driven Ground Rods
 - 2.10.2 Grounding Conductors
- 2.11 FACTORY TESTS
- 2.12 COORDINATED POWER SYSTEM PROTECTION
 - 2.12.1 Scope of Analyses
 - 2.12.2 Determination of Facts
 - 2.12.3 Single Line Diagram
 - 2.12.4 Fault Current Analysis

- 2.12.5 Method
- 2.12.6 Data
- 2.12.7 Fault Current Availability
- 2.12.8 Coordination Study
- 2.12.9 Study Report

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
 - 3.1.1 Conformance to Codes
 - 3.1.2 Verification of Dimensions
 - 3.1.3 Disposal of Liquid Dielectrics
- 3.2 POLE INSTALLATION
 - 3.2.1 Wood Pole Setting
- 3.3 CONDUCTOR INSTALLATION
 - 3.3.1 Line Conductors
 - 3.3.2 Connectors and Splices
 - 3.3.3 Conductor-To-Insulator Attachments
 - 3.3.4 Armor Rods
- 3.4 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS
- 3.5 CONNECTIONS TO BUILDINGS
 - 3.5.1 Underground Services
- 3.6 GROUNDING
 - 3.6.1 Grounding Electrodes
 - 3.6.2 Grounding and Bonding Connections
 - 3.6.3 Grounding Electrode Conductors
- 3.7 FIELD TESTING
 - 3.7.1 General
 - 3.7.2 Safety
 - 3.7.3 Ground-Resistance Tests
 - 3.7.4 Sag and Tension Test
 - 3.7.5 Operating Tests
- 3.8 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16370

ELECTRICAL DISTRIBUTION SYSTEM, AERIAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|--------------|---|
| ANSI C29.1 | (1988) Electrical Power Insulators - Test Methods |
| ANSI C29.2 | (1992) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type |
| ANSI C29.3 | (1986) Wet Process Porcelain Insulators - Spool Type |
| ANSI C29.5 | (1984; R 1991) Wet-Process Porcelain Insulators - Low- and Medium-Voltage Types |
| ANSI C29.6 | (1984) Wet-Process Porcelain Insulators - High-Voltage Pin Type |
| ANSI C29.8 | (1985) Wet-Process Porcelain Insulators - Apparatus, Cap and Pin Type |
| ANSI C29.9 | (1983) Wet-Process Porcelain Insulators - Apparatus, Post-Type |
| ANSI C135.1 | (1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction |
| ANSI C135.2 | (1987) Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction |
| ANSI C135.4 | (1987) Zinc-Coated Ferrous Eyebolts and Nuts for Overhead Line Construction |
| ANSI C135.14 | (1979) Staples with Rolled or Slash Points for Overhead Line Construction |
| ANSI C135.17 | (1988) Insulator Pins with Lead Threads for Overhead Line Construction Galvanized Ferrous Bolt-Type |
| ANSI C135.22 | (1988) Galvanized Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction |

ANSI C135.33 (1988) Crossarm Gains, Galvanized Ferrous

ANSI O5.1 (1992) Specifications and Dimensions for
Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings
on Iron and Steel Products

ASTM A 153 (1996) Zinc Coating (Hot-Dip) on Iron and
Steel Hardware

ASTM A 575 (1989) Steel Bars, Carbon, Merchant
Quality, M-Grades

ASTM A 576 (1990b) Steel Bars, Carbon, Hot-Wrought,
Special Quality

ASTM B 1 (1990) Hard-Drawn Copper Wire

ASTM B 8 (1993) Concentric-Lay-Stranded Copper
Conductors, Hard, Medium-Hard, or Soft

ASTM B 117 (1994) Operating Salt Spray (Fog) Testing
Apparatus

ASTM B 232 (1992) Concentric-Lay-Stranded Aluminum
Conductors, Coated-Steel Reinforced (ACSR)

ASTM D 1654 (1992) Evaluation of Painted or Coated
Specimens Subjected to Corrosive
Environment

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C4 (1995) Poles - Preservative Treatment by
Pressure Processes

AWPA P1/P13 (1995) Standard for Coal Tar Creosote for
Land and Fresh Water and Marine (Coastal
Water Use)

AWPA P5 (1995) Standards for Waterborne
Preservatives

AWPA P8 (1995) Standards for Oil-Borne
Preservatives

AWPA P9 (1992) Standards for Solvents and
Formulations for Organic Preservative
Systems

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C37.41 (1994) Design Tests for High-Voltage

Fuses, Distribution Enclosed Single-Pole
Air Switches, Fuse Disconnecting Switches,
and Accessories

| | |
|----------------|--|
| IEEE C57.19.00 | (1991) IEEE Standard General Requirements and Test Procedures for Outdoor Power Apparatus Bushings |
| IEEE C57.19.01 | (1991) IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings |
| IEEE C62.1 | (1989; R 1994) Surge Arresters for ac Power Circuits |
| IEEE C62.2 | (1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems |
| IEEE C62.11 | (1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits |
| IEEE Std 81 | (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) |
| IEEE Std 100 | (1992) IEEE Standard Dictionary of Electrical and Electronics Terms |
| IEEE Std 242 | (1986; R 1991) Recommended Practice for Protection and coordination of Industrial and Commercial Power Systems |
| IEEE Std 399 | (1990) Recommended Practice for Power Systems Analysis |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|-----------|--|
| NEMA HV 2 | (1984; R 1991) Application Guide for Ceramic Suspension Insulators |
| NEMA LA 1 | (1992) Surge Arresters |
| NEMA SG 2 | (1993) High Voltage Fuses |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---------|---------------------------------|
| NFPA 70 | (1996) National Electrical Code |
|---------|---------------------------------|

UNDERWRITERS LABORATORIES (UL)

| | |
|---------|--|
| UL 467 | (1993; Rev thru Aug 1996) Grounding and Bonding Equipment |
| UL 486A | (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors |

UL 486B

(1991; Rev thru Oct 1996) Wire Connectors
for Use with Aluminum Conductors

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fault Current and Protective Device Coordination Study; GA

The study shall be submitted along with protective device equipment submittals. No time extensions or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device settings, ratings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog; GA

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include the item number, the quantity of items proposed, and the name of the manufacturer of the item.

SD-04 Drawings

Electrical Distribution System; GA

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings. Detail drawings shall as a minimum include:

- a. Poles.
- b. Fused Cut-Outs.
- c. Conductors.
- d. Insulators.

e. Surge arresters.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

- a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded.
- b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

As-Built Drawings; GA

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-09 Reports

Factory Test; FIO

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests

specified in applicable publications or in these specifications.

Field Testing; FIO

A proposed field test plan 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports; GA.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of 5 rings, and including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

SD-13 Certificates

Materials and Equipment; GA

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies.

SD-19 OPERATION AND MAINTENANCE MANUALS

Electrical Distribution System; GA

Six copies of Operation and Maintenance manuals electrical distribution

system shall be provided, within 7 calendar days following the completion of tests and shall include assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare-parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers. Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

Three additional copies of the instructions manual within 30 calendar days following the approval of the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than inch in depth shall not be used.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the Contracting Officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.3 NAMEPLATES

2.3.1 General

Each major component shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Equipment containing liquid-dielectrics shall have the type of dielectric on the nameplate. Nameplates shall be made of noncorrosive metal. As a minimum, nameplates shall be provided for switches.

2.4 CORROSION PROTECTION

2.4.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

2.4.2 Ferrous Metal Materials

2.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

2.4.2.2 Equipment

Equipment and component items, including but not limited to ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The described test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.4.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.5 CONDUCTORS, CONNECTORS, AND SPLICES

2.5.1 Aluminum-Composition Conductors

Aluminum-conductor-steel-reinforced, ACSR, shall comply with ASTM B 232.

2.5.2 Copper Conductors

Hard-drawn-copper conductors shall comply with ASTM B 1 and ASTM B 8 as appropriate for the conductor size.

2.5.3 Connectors and Splices

Connectors and splices shall be of copper alloys for copper conductors,

aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition and aluminum-composition to copper shall comply with UL 486B, and copper-to-copper shall comply with UL 486A.

2.6 POLES AND HARDWARE

Poles shall be of lengths and classes indicated.

2.6.1 Wood Poles

Wood poles shall comply with ANSI O5.1, and shall be pressure treated in accordance with AWP A C4, with creosote conforming to AWP A P1/P13 or with oil-borne preservatives and petroleum conforming to AWP A P8 and AWP A P9, respectively, and waterborne preservatives conforming to AWP A P5. Waterborne preservatives shall be either chromated or ammoniacal copper arsenate. Any species listed in ANSI O5.1 for which a preservative treatment is not specified in AWP A C4, shall not be used; northern white cedar, if treated as specified for western red cedar, and western fir, if treated as specified for Douglas fir, may be used. Wood poles shall have pole markings located approximately 10 feet from pole butts for poles 50 feet or less in length, and 14 feet from the pole butts for poles longer than 55 feet in length. Poles shall be machine trimmed by turning smooth full length, and shall be roofed, galled, and bored prior to pressure treatment. Where poles are not provided with factory-cut galls, metal gall plates shall be provided.

2.6.2 Pole Line Hardware

Zinc-coated hardware shall comply with ANSI C135.1, ANSI C135.2, ANSI C135.4, ANSI C135.14, ANSI C135.17, ANSI C135.22, and ANSI C135.33. Steel hardware shall comply with ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153. Pole-line hardware shall be hot-dip galvanized steel. Washers shall be installed under boltheads and nuts on wood surfaces and elsewhere as required. Washers used on through-bolts and double-arming bolts shall be approximately 2-1/4 inches square and 3/16 inch thick. The diameter of holes in washers shall be the correct standard size for the bolt on which a washer is used. Washers for use under heads of carriage-bolts shall be of the proper size to fit over square shanks of bolts. Eye bolts, bolt eyes, eyenuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises shall be used wherever required to support and to protect poles, brackets, guy wires, and insulators.

2.6.3 Armless Construction

Pole mounting brackets for line-post or pin insulators and eye bolts for suspension insulators shall be as shown. Brackets shall be attached to poles with a minimum of two bolts. Brackets may be either provided integrally as part of an insulator or attached to an insulator with a suitable stud. Bracket mounting surface shall be suitable for the shape of the pole. Brackets for wood poles shall have wood gripping members. Pole top brackets shall conform to ANSI C135.22, except for modifications necessary to provide support for a line-post insulator. Brackets shall provide a strength exceeding that of the required insulator strength, but in no case less than a 2800 pound cantilever strength.

2.6.4 Guy Assemblies

Guy assemblies shall be zinc-coated steel in accordance with ASTM A 475. Guy assemblies, including insulators and attachments, shall provide a strength exceeding the required guy strength. Anchors shall provide adequate strength to support all loads. Guy strand shall be 7 strand. Guy material shall be zinc-coated-steel high-strength grade, with a minimum breaking strength not less than 6,000 pounds, except where two or more guys are used to provide the required strength. Guy rods shall be not less than 8 feet in length by 1-1/4 inch in diameter.

2.7 INSULATORS

Insulators shall comply with NEMA HV 2 for general requirements.

2.7.1 Medium-Voltage Line Insulators

Medium-voltage line insulators shall comply with ANSI C29.2, ANSI C29.5, and ANSI C29.6, and as applicable. Ratings shall not be lower than the ANSI classes indicated in TABLE I. Horizontal line-post insulators shall be used for armless construction and shall have the same mechanical and electrical ratings as vertical line-post insulators for the ANSI class indicated, but shall be modified to be suitable for horizontal installation. Where line-post insulators are used for angles greater than 15 degrees, clamp-top fittings shall be provided as well as for other locations shown. Conductor clamps for use with clamp-top, line-post insulators shall be hot-dip galvanized malleable iron for copper conductors and aluminum alloy for aluminum-composition conductors. Either line-post or pin insulators may be used for crossarm construction. Pin insulators for use on voltages in excess of 6 kV phase-to-phase shall be radio-interference-free or else line-post insulators shall be used.

TABLE I

MINIMUM ANSI RATING OF MEDIUM-VOLTAGE INSULATORS BY CLASS

| Voltage Level | Line-Post | Pin | Suspension |
|---------------|------------|------|---------------|
| 6 kV to 15 kV | 57-1 or 11 | 55-5 | Two 52-2 |
| | 57-2 or 12 | 56-3 | Two 52-3 or 4 |

2.7.2 Low-Voltage Line Insulators

Low-voltage line insulators shall comply with ANSI C29.2 and ANSI C29.3 as applicable. Spool insulators for use on low-voltage lines shall be mounted on clevis attachments or secondary racks and shall be not smaller than Class 53-3.

2.7.3 Apparatus Insulators

Apparatus insulators shall comply with IEEE C57.19.00, IEEE C57.19.01, ANSI C29.8, and ANSI C29.9 as applicable.

2.8 FUSES AND SWITCHES, MEDIUM-VOLTAGE

2.8.1 Fuse Cutouts

Medium-voltage fuses and cutouts shall comply with NEMA SG 2 and shall be

of the loadbreak open type construction rated 15 kV and of the extra-heavy type. Open-link cut-outs are not acceptable. Fuses shall be either indicating or dropout type. Fuse ratings shall be as indicated. Fuse cutouts shall be equipped with mounting brackets suitable for the indicated installations.

2.9 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1 and IEEE C62.1, IEEE C62.2, and IEEE C62.11, and shall be provided for protection of aerial-to-underground transitions, other indicated equipment. Arresters shall be intermediate class, rated as shown. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor type suitable for outdoor installations.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

2.10.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.11 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing.

- a. High-Voltage Fuses: Manufacturer's standard tests in accordance with IEEE C37.41.
- b. Electric Power Insulators: Manufacturer's standard tests in accordance with ANSI C29.1.

2.12 COORDINATED POWER SYSTEM PROTECTION

Analyses shall be prepared to demonstrate that the equipment selected and system constructed meet the contract requirements for equipment ratings, coordination, and protection. They shall include a load flow analysis, a fault current analysis, and a protective device coordination study. The studies shall be performed by a registered professional engineer with demonstrated experience in power system coordination in the last three years. The Contractor shall provide list of references complete with points of contact, address and telephone numbers. The selection of the engineer is subject to the approval of the Contracting Officer.

2.12.1 Scope of Analyses

The fault current analysis, and protective device coordination study shall

begin at: the source bus and extend down to system buses where fault availability is 10,000 amperes (symmetrical).

2.12.2 Determination of Facts

The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the for fault current availability at the site.

2.12.3 Single Line Diagram

A single line diagram shall be prepared to show the electrical system buses, devices, transformer points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram may be provided. Each bus, device or transformer point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram together with available fault data, and the device interrupting rating.

2.12.4 Fault Current Analysis

2.12.5 Method

The fault current analysis shall be performed in accordance with methods described in IEEE Std 242 and IEEE Std 399.

2.12.6 Data

Actual data shall be utilized in fault calculations. Bus characteristics and transformer impedances shall be those proposed. Data shall be documented in the report.

2.12.7 Fault Current Availability

Balanced three-phased fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. The maximum and minimum values of fault available at each location shall be shown in tabular form on the diagram or in the report.

2.12.8 Coordination Study

The study shall demonstrate that the maximum possible degree of selectivity has been obtained between devices specified, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and relay settings. Recommendations to improve or enhance system reliability, and detail where such changes would involve additions or modifications to the contract and cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.

2.12.9 Study Report

- a. The report shall include a narrative describing: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.
- b. The study shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include manufacturers published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.
- c. The report shall document utility company data including system voltages, fault MVA, system X/R ratio, time-current characteristics curves, current transformer ratios, and relay device numbers and settings; and existing power system data including time-current characteristics curves and protective device ratings and settings.
- d. The report shall contain fully coordinated composite time-current characteristic curves for each bus in the system, as required to ensure coordinated power system between protective devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.
- e. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed in conduits or underground and splices and terminations for medium-voltage cable shall conform to the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Secondary circuits installed in conduit on poles shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of IEEE C2 for medium loading districts, Grade B construction. No reduction in clearance shall be made. The installation shall also comply with the applicable parts of NFPA 70.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectric shall be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor

shall furnish certification of proper disposal. Contaminated dielectric shall not be diluted to lower the level of contamination.

3.2 POLE INSTALLATION

Poles for overhead electric and communication lines shall be wood poles utilizing armless construction. Provision for communication services is required on pole-line construction, except where specifically noted otherwise.

3.2.1 Wood Pole Setting

Wood Pole Setting: Wood poles shall be set straight and firm. In normal firm ground, minimum pole-setting depths shall be as listed in Table II. In rocky or swampy ground, pole-setting depths shall be decreased or increased respectively in accordance with the local utility's published standards and as approved. In swampy or soft ground, a bog shoe shall be used where support for a pole is required. Poles in straight runs shall be in a straight line. Curved poles shall be placed with curvatures in the direction of the pole line. Poles shall be set to maintain as even a grade as practicable. When the average ground run is level, consecutive poles shall not vary more than 5 feet in height. When the ground is uneven, poles differing in length shall be kept to a minimum by locating poles to avoid the highest and lowest ground points. If it becomes necessary to shorten a pole, a piece shall be sawed off the top end and roofed. If any pole is shortened after treatment, the shortened end of the pole shall be given an application of hot preservative. Where poles are set on hilly terrain, along edges of cuts or embankments, or where soil may be washed out, special precautions shall be taken to ensure durable pole foundations, and the setting depth shall be measured from the lower side of the pole. Holes shall be dug large enough to permit proper use of tampers to the full depth of a hole. Earth shall be placed into the hole in 6 inch maximum layers, then thoroughly tamped before the next layer is placed. Surplus earth shall be placed around each pole in a conical shape and packed tightly to drain water away from poles.

TABLE II

MINIMUM POLE-SETTING DEPTH (FEET)

| Length Overall Feet | Straight Lines | Curves, Corners, and Points of Extra Strain |
|---------------------------|-------------------|--|
| 45 | 6.5 | 7.0 |
| 50 | 7.0 | 7.5 |

3.3 CONDUCTOR INSTALLATION

3.3.1 Line Conductors

Unless otherwise indicated, conductors shall be installed in accordance with manufacturer's approved tables of sags and tensions. Proper care shall be taken in handling and stringing conductors to avoid abrasions, sharp bends, cuts, kinks, or any possibility of damage to insulation or conductors. Conductors shall be paid out with the free end of conductors fixed and cable reels portable, except where terrain or obstructions make

this method unfeasible. Bend radius for any insulated conductor shall not be less than the applicable NEMA specification recommendation. Conductors shall not be drawn over rough or rocky ground, nor around sharp bends. When installed by machine power, conductors shall be drawn from a mounted reel through stringing sheaves in straight lines clear of obstructions. Initial sag and tension shall be checked by the Contractor, in accordance with the manufacturer's approved sag and tension charts, within an elapsed time after installation as recommended by the manufacturer.

3.3.2 Connectors and Splices

Connectors and splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Aluminum-composition conductors shall be wire brushed and an oxide inhibitor applied before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Inhibitors and compression tools shall be of types recommended by the connector manufacturer. Primary line apparatus taps shall be by means of hot line clamps attached to compression type bail clamps (stirrups).

3.3.3 Conductor-To-Insulator Attachments

Conductors shall be attached to insulators by means of clamps, shoes or tie wires, in accordance with the type of insulator. For insulators requiring conductor tie-wire attachments, tie-wire sizes shall be as indicated in TABLE II.

TABLE II

TIE-WIRE REQUIREMENTS

| CONDUCTOR | TIE WIRE |
|--------------------------|-------------------|
| AAC, AAAC, or ACSR (AWG) | AAAC OR AAC (AWG) |
| Any size | 6 or 4 |

3.3.4 Armor Rods

Armor rods shall be provided for AAC, AAAC, and ACSR conductors. Armor rods shall be installed at supports, except armor rods will not be required at primary dead-end assemblies if aluminum or aluminum-lined zinc-coated steel clamps are used. Lengths and methods of fastening armor rods shall be in accordance with the manufacturer's recommendations. For span lengths of less than 200 feet, flat aluminum armor rods may be used. Flat armor rods, not less than 0.03 by 0.25 inch shall be used on No. 1 AWG AAC and AAAC and smaller conductors and on No. 5 AWG ACSR and smaller conductors. On larger sizes, flat armor rods shall be not less than 0.05 by 0.30 inches. For span lengths of 200 feet or more, preformed round armor rods shall be used.

3.4 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to poles by two-hole galvanized

steel pipe straps spaced not more than 10 feet apart and with one support not more than 12 inches from any bend or termination. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the riser conduit. Risers shall be equipped with bushings to protect cables.

3.5 CONNECTIONS TO BUILDINGS

3.5.1 Underground Services

Connections to buildings shall be made at the point indicated and shall be terminated at the service entrance equipment terminals. Cable pulling shall be in accordance with Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Service entrance conduits with termination fittings and conductors within the building shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

3.6 GROUNDING

Noncurrent-carrying metal parts of equipment and conductor assemblies, such as luminaires, medium-voltage cable terminations panel enclosures, and other noncurrent-carrying metal items shall be grounded. Additional grounding of equipment, neutral, and surge arrester grounding systems shall be installed at poles where indicated.

3.6.1 Grounding Electrodes

Grounding electrodes shall be installed as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be located approximately 3 feet out from base of the pole and shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade. Multiple rods shall be evenly spaced at least 10 feet apart and connected together 2 feet below grade with a minimum No. 4 bare copper conductor.

3.6.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.6.3 Grounding Electrode Conductors

On multi-grounded circuits, as defined in IEEE C2, provide a single continuous vertical grounding electrode conductor. Neutrals, surge arresters, and equipment grounding conductors shall be bonded to this conductor. Grounding electrode conductors shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3.7 FIELD TESTING

3.7.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 5 days prior to conducting tests. The Contractor shall furnish materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results.

Field reports will be signed and dated by the Contractor.

3.7.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.7.3 Ground-Resistance Tests

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes shall be provided.

3.7.4 Sag and Tension Test

The Contracting Officer shall be given prior notice of the time schedule for stringing conductors or cables serving overhead medium-voltage circuits and reserves the right to witness the procedures used for ascertaining that initial stringing sags and tensions are in compliance with requirements for the applicable loading district and cable weight.

3.7.5 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.8 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Terminology
- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE, AND HANDLING
- 1.5 EXTRA MATERIALS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCT
- 2.2 NAMEPLATES
 - 2.2.1 General
 - 2.2.2 Liquid-Filled Transformer Nameplates
- 2.3 CORROSION PROTECTION
 - 2.3.1 Ferrous Metal Materials
 - 2.3.1.1 Hardware
 - 2.3.1.2 Equipment
 - 2.3.2 Finishing
- 2.4 CABLES
 - 2.4.1 Conductor Material
 - 2.4.2 Medium-Voltage Cables
 - 2.4.2.1 General
 - 2.4.2.2 Insulation
 - 2.4.2.3 Jackets
 - 2.4.2.4 Neutrals
 - 2.4.2.5 Shielding
 - 2.4.2.6 Ratings
 - 2.4.3 Low-Voltage Cables
 - 2.4.3.1 Direct Buried
- 2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS
 - 2.5.1 Medium-Voltage Cable Joints
 - 2.5.2 Medium-Voltage Separable Insulated Connectors
 - 2.5.3 Low-Voltage Cable Splices
 - 2.5.4 Terminations
 - 2.5.4.1 Factory Preformed Type
- 2.6 CONDUIT AND DUCTS
 - 2.6.1 Metallic Conduit
 - 2.6.2 Nonmetallic Ducts
 - 2.6.2.1 Concrete Encased Ducts
 - 2.6.2.2 Direct Burial
 - 2.6.3 Conduit Sealing Compound
- 2.7 POLES AND HARDWARE
- 2.8 TRANSFORMERS AND SWITCHGEAR
 - 2.8.1 Pad-Mounted Transformers

- 2.8.1.1 High-Voltage Compartments
- 2.8.1.2 Load-Break Switch
- 2.8.1.3 Transformer Tank Sections
- 2.8.1.4 Low-Voltage Cable Compartments
- 2.8.1.5 Accessories
- 2.8.2 Pad-Mounted, Air Insulated, Switchgear
 - 2.8.2.1 Ratings at 60 Hz shall be:
 - 2.8.2.2 Operators, Devices, and Controls
 - 2.8.2.3 Enclosures
- 2.8.3 Single Phase Pad-Mounted Transformer
 - 2.8.3.1 Terminating Compartment
 - 2.8.3.2 Terminating High Voltage
 - 2.8.3.3 Terminating Low Voltage
 - 2.8.3.4 Transformer
- 2.9 SURGE ARRESTERS
- 2.10 GROUNDING AND BONDING
 - 2.10.1 Driven Ground Rods
 - 2.10.2 Grounding Conductors
- 2.11 CONCRETE AND REINFORCEMENT
- 2.12 LIQUID DIELECTRICS
- 2.13 FACTORY TESTS

PART 3 EXECUTION

- 3.1 GENERAL INSTALLATION REQUIREMENTS
 - 3.1.1 Conformance to Codes
 - 3.1.2 Verification of Dimensions
 - 3.1.3 Disposal of Liquid Dielectrics
- 3.2 CABLE INSTALLATION
 - 3.2.1 Cable Installation Plan and Procedure
 - 3.2.1.1 Cable Inspection
 - 3.2.1.2 Duct Cleaning
 - 3.2.1.3 Duct Lubrication
 - 3.2.1.4 Cable Installation
 - 3.2.1.5 Cable Installation Plan
 - 3.2.2 Duct Line
 - 3.2.3 Direct-Burial
 - 3.2.3.1 Trenching
 - 3.2.3.2 Cable Burial
 - 3.2.3.3 Other Requirements
- 3.3 CABLE JOINTS
- 3.4 DUCT LINES
 - 3.4.1 Requirements
 - 3.4.2 Treatment
 - 3.4.3 Concrete Encasement
 - 3.4.4 Nonencased Direct-Burial
 - 3.4.5 Installation of Couplings
 - 3.4.5.1 Plastic Duct
- 3.5 PAD-MOUNTED EQUIPMENT INSTALLATION
 - 3.5.1 Concrete Pads
 - 3.5.1.1 Construction
 - 3.5.1.2 Concrete and Reinforcement
 - 3.5.1.3 Sealing
- 3.6 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS
 - 3.6.1 Pole Installation
- 3.7 CONNECTIONS TO BUILDINGS
- 3.8 GROUNDING
 - 3.8.1 Grounding Electrodes
 - 3.8.2 Grounding and Bonding Connections

- 3.8.3 Grounding and Bonding Conductors
- 3.8.4 Surge Arrester Grounding
- 3.8.5 Riser Pole Grounding
- 3.9 FIELD TESTING
 - 3.9.1 General
 - 3.9.2 Safety
 - 3.9.3 Ground-Resistance Tests
 - 3.9.4 Medium-Voltage Cable Test
 - 3.9.5 Low-Voltage Cable Test
 - 3.9.6 Liquid-Filled Transformer Tests
 - 3.9.7 Pre-Energization Services
 - 3.9.8 Operating Tests
- 3.10 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|----------------|---|
| ANSI C29.1 | (1988) Electrical Power Insulators - Test Methods |
| ANSI C37.72 | (1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems |
| ANSI C57.12.21 | (1980) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; (High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller) |
| ANSI C57.12.26 | (1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVa and Smaller |
| ANSI C57.12.28 | (1988) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity |
| ANSI C80.1 | (1990) Rigid Steel Conduit - Zinc Coated |
| ANSI C119.1 | (1986) Sealed Insulated Underground Connector Systems Rated 600 Volts |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|------------|--|
| ASTM A 123 | (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A 153 | (1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| ASTM B 8 | (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft |

ASTM B 117 (1994) Operating Salt Spray (Fog) Testing Apparatus

ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS5 (1994) Specifications for Cross-linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV

AEIC CS6 (1987; Rev Mar 1989) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C37.20.1 (1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear

IEEE C37.20.2 (1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear

IEEE C37.20.3 (1987) Metal-Enclosed Interrupter Switchgear

IEEE C57.12.00 (1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

IEEE C62.1 (1989; R 1994) Surge Arresters for ac Power Circuits

IEEE C62.11 (1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits

IEEE Std 48 (1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV

IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

IEEE Std 100 (1992) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 386 (1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V

IEEE Std 404 (1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 46 000 V and Cable Joints for Use with

Laminated Dielectric Cable Rated 2500 V
Through 500 000 V

IEEE Std 592

(1990) Exposed Semiconducting Shields on
Premolded High Voltage Cable Joints and
Separable Insulated Connectors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA FB 1

(1993) Fittings, Cast Metal Boxes and
Conduit Bodies for Conduit and Cable
Assemblies

NEMA LA 1

(1992) Surge Arresters

NEMA TC 6

(1990) PVC and ABS Plastic Utilities Duct
for Underground Installation

NEMA WC 7

(1993)
Cross-Linked-Thermosetting-Polyethylene-
Insulated Wire and Cable for the
Transmission and Distribution of
Electrical Energy

NEMA WC 8

(1993) Ethylene-Propylene-Rubber-Insulated
Wire and Cable for the Transmission and
Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(1996) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6

(1993; Rev March 96) Rigid Metal Conduit

UL 467

(1993; Rev thru Aug 1996) Grounding and
Bonding Equipment

UL 486A

(1991; Rev Oct 1991) Wire Connectors and
Soldering Lugs for Use with Copper
Conductors

UL 514A

(1996) Metallic Outlet Boxes

UL 651

(1995) Schedule 40 and 80 Rigid PVC Conduit

UL 854

(1996; Rev May 1996) Service-Entrance
Cables

UL 1242

(1996) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.3 SUBMITTALS

Governmental approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Fault Current and Protective Devices Coordination Studies; GA.

The study shall be submitted with protective device equipment submittals. No time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed shall be based on recommendations of this study. The Government shall not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered and/or procured prior to approval of the study.

Manufacturer's Catalog Data; GA

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; GA

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

Installation Procedures; FIO

As a minimum, installation procedures for transformers, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings

Electrical Distribution System; GA

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as

a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

- a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.
- b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

- a. Medium-voltage cables and accessories including cable installation plan.
- b. Transformers.
- c. Switchgear.
- d. Pad-mounted loadbreak switches.
- e. Surge arresters.

As-Built Drawings; GA

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-09 Reports

Factory Test; GA

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards

listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing; GA.

A proposed field test plan, 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports; GA.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Cable Installation Reports; GA.

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

SD-13 Certificates

Materials and Equipment; FIO

Where materials or equipment are specified to conform to the standards of

the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Splicer Qualification; GA

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications; GA

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-19 OPERATION AND MAINTENANCE MANUALS

Electrical Distribution System; GA.

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be

taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is

non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Ferrous Metal Materials

2.3.1.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153 and ASTM A 123.

2.3.1.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 480 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.2 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Conductor Material

Underground cables shall be of soft drawn copper conductor material.

2.4.2 Medium-Voltage Cables

2.4.2.1 General

Medium voltage cables shall conform to the requirements of NEMA WC 8 for cables utilizing ethylene-propylene-rubber (EPR) insulation. Cables shall be in accordance with the requirements of NFPA 70.

2.4.2.2 Insulation

Cables shall utilize ethylene-propylene-rubber (EPR) insulation. Cables shall be provided with 133 percent insulation level.

2.4.2.3 Jackets

Cables shall be provided with a nonmetallic jacket. Concentric neutral cables for direct buried applications shall have a moisture-resistant, nonmetallic jacket rated for direct burial.

2.4.2.4 Neutrals

Neutral conductors of grounded neutral systems except for concentric neutral cables shall be of the same insulation material as phase conductors, except that a 600-volt insulation rating is acceptable. Cables employing a concentric neutral shall have full concentric neutral with an insulating jacket over the concentric neutral.

2.4.2.5 Shielding

Cables rated for above 2 kV shall have both conductor and insulation shielding for each phase.

2.4.2.6 Ratings

Medium-voltage cables shall be rated for a circuit voltage of 15 kV.

2.4.3 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70.

2.4.3.1 Direct Buried

Service entrance cables shall conform to UL 854 for Type USE service entrance cable. Secondary power cable will be multi-conductor nonmetallic, sheathed, and 600 volt rated; it will consists of 3 THW, THWN, or XHHW insulated stranded copper grounding conductor. The cable shall be filled to round with non-hygroscopic fillers, have an overall corrugated 5 mils uncoated copper tape shield, and be enclosed within a tight fitting heavy neoprene or PVC jacket suitable for direct burial.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with IEEE Std 404 and IEEE Std 592. Medium-voltage cable terminations shall comply with IEEE Std 48. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have ratings not less than the ratings of the cables on which they are installed.

2.5.2 Medium-Voltage Separable Insulated Connectors

Separable insulated connectors shall comply with IEEE Std 386 and IEEE Std 592 and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. External clamping points and test points shall be provided.

2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

2.5.4 Terminations

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, prestretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding.

2.5.4.1 Factory Preformed Type

Molded elastomer, wet-process porcelain, prestretched, and heat-shrinkable terminations shall utilize factory preformed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level. Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level.

2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type for duct lines for other medium-voltage lines. Low-voltage lines or Communication lines run elsewhere may be direct-burial, thick-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

2.6.2.2 Direct Burial

UL 651 Schedule 40 or NEMA TC 6 Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 POLES AND HARDWARE

Poles and hardware shall be in accordance with Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

2.8 TRANSFORMERS AND SWITCHGEAR

Transformers and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

2.8.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the loop feed type. Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock.

2.8.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary protective devices shall include loadbreak switching, drawout, dry-well-mounted, current-limiting fuses medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on the same bushing as the primary cable by means of a loadbreak, feed-through bushing insert

2.8.1.2 Load-Break Switch

Radial-feed oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 ampere, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

2.8.1.3 Transformer Tank Sections

Transformers shall comply with IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the mineral oil-insulated type. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as indicated on the drawings.

2.8.1.4 Low-Voltage Cable Compartments

Neutrals shall be provided with fully-insulated bushings. Clamp type cable terminations, suitable for copper conductors entering from below, shall be provided as necessary.

2.8.1.5 Accessories

High-voltage warning signs shall be permanently attached to each side of transformer stations. Voltage warning signs shall comply with IEEE C2. Copper-faced steel or stainless steel ground connection pads shall be provided in both the high- and low-voltage compartments. Dial-type thermometer, liquid-level gauge, and drain valve with built-in sampling device shall be provided for each transformer station. Insulated-bushing-type parking stands shall be provided adjacent to each separable load-break elbow.

2.8.2 Pad-Mounted, Air Insulated, Switchgear

The switchgear shall be configured with 2 incoming compartments for loop-feed arrangement, one incoming compartment for radial-feed, equipped with air-insulated, load-interrupter switches, as indicated. The outgoing compartments shall be provided with fused disconnects, as indicated.

2.8.2.1 Ratings at 60 Hz shall be:

| | |
|---|---------|
| Nominal voltage (kV) | 15. |
| Rated maximum voltage (kV) | 15.5. |
| Rated continuous current (A) | 600. |
| Maximum symmetrical interrupting capacity (kA) | 12,000. |
| Maximum asymmetrical interrupting capacity (kA) | 19,200 |
| BIL (kV) | 95 |

2.8.2.2 Operators, Devices, and Controls

Operators and controls shall be provided for the switchgear as follows:

- a. Switches shall be provided with a manual, handle-type operator or a push-button mechanical spring tripping mechanism, utilizing a store-energy (spring-driven) mechanism to simultaneously open or close all phases. The switchgear shall be configured so that the switch actuator is padlockable, but may be accessed without opening the switch compartment doors.
- b. Fused disconnects shall be hook-stick operated.

2.8.2.3 Enclosures

Switchgear enclosures shall be of freestanding self-supporting construction provided with separate incoming and outgoing compartments configured for bottom cable entry. Enclosures shall be of deadfront construction, provided with a hinged door for access to each compartment, and conform to the requirements of ANSI C57.12.28, ANSI C37.72, and IEEE C37.20.3, Category A.

2.8.3 Single Phase Pad-Mounted Transformer

ANSI C57.12.21, provided with load-break connectors, fuses, and accessories. Provide enclosure constructed of reinforced formed steel sheets not less than No. 13 U.S. gauge, painted olive green, and delivered fully assembled and ready for operation.

2.8.3.1 Terminating Compartment

Provide integral with the transformer having the high voltage terminals on the left facing front and a low voltage terminals on the right. The door of the terminating compartment shall be of sufficient size to provide adequate working space, and shall open 180 degrees and rest securely on tank top and designed for removal and for latching in the closed position.

2.8.3.2 Terminating High Voltage

The high voltage side shall contain the incoming line, load-break separable connectors, and access to dry-well fuse holders with current limiting fuses, tap changer, surge arresters, high voltage bushings, and cable accessory parking stand. Arrange incoming line equipment for loop feed.

- a. Insulated High Voltage Loadbreak Connectors: IEEE Std 386, rated 95 kV BIL, 8.3 kV for operation on a 15 kV system. Current rate: 200 amps rms continuous, 10,000 amps rms, symmetrical short-time for a time duration of .20 seconds. Load-break connectors, inserts, and bushing shall be in the product of a single manufacturer. Connector shall have a steel reinforced hook-stick eye, grounding eye, and arc-quenching contact material.
- b. Current Limiting Fuses: ANSI C37.47. Provide fuses in air-insulated, oil-sealed, dead-front dry-well fuse holders. The fuses shall remove the transformer from service in case of an internal fault. Size fuses to approximately 150 percent of the transformer rating and adequately coordinate with the low voltage breaker so that the low voltage breaker clears any low voltage fault or overload before the high voltage fuses begin to melt.

The fuses shall have an interrupting rating of 50,000 RMS asymmetrical amps at the system voltage specified.

2.8.3.3 Terminating Low Voltage

Low voltage side shall contain cable lugs and low voltage bushings.

2.8.3.4 Transformer

Oil insulated, two winding, 60 Hz, 65 degree C rise above a 30 degree C average ambient, self cooled type. Transformer shall be rated 95 kV BIL, high voltage of 7.2 kV and low voltage of 240/120 volts, kVA size as indicated. Provide transformer with four 2-1/2 percent full capacity taps, two above and two below rated primary voltage. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Impedance shall be not less than 2.0 percent.

Accessories shall include drain plug, filler connection, liquid level, plug, grounding pads, lifting lugs, provisions for jacking under base, and stainless steel nameplate. The transformer base construction shall be of the fabricated type and suitable for using rollers or skidding in any direction. The transformer shall have an insulated low voltage neutral bushing with removable ground strap with lugs for ground cable. Transformer shall have its kVA rating conspicuously displayed on its enclosure. Locate devices and connections on front of transformer within the terminating compartment.

2.9 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, and IEEE C62.11 and shall be provided where indicated. Arresters shall be rated as shown. Arresters shall be of the metal-oxide varistor type.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used.

2.10.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.11 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section 03200 CONCRETE REINFORCEMENT.

2.12 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl

(PCB) mineral-oil. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts per million (ppm) PCB content.

2.13 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

- a. Transformers: Manufacturer's standard routine design and other tests in accordance with IEEE C57.12.00.
- b. Factory Preformed Terminations: Wet withstand voltage tests in accordance with IEEE Std 48 for the next higher BIL level.
- c. Outdoor Switchgear: Manufacturer's standard tests in accordance with IEEE C37.20.1, IEEE C37.20.2, and IEEE C37.20.3.
- d. Electrical Power Insulators: Manufacturer's standard tests in accordance with ANSI C29.1.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed aerially shall conform to the requirements of Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Concrete work shall have minimum 3000 psicompressive strength and conform to the requirements of Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then prepare a checklist of significant requirements which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS.

Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Medium-voltage cables and low-voltage cables shall be installed in duct lines where indicated. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 Direct-Burial

Medium-voltage cables and low-voltage cables shall be buried directly in the earth as indicated.

3.2.3.1 Trenching

Trenches for direct-burial cables shall be excavated to depths required to provide the minimum necessary cable cover. Bottoms of trenches shall be smooth and free of stones and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil.

3.2.3.2 Cable Burial

Cables shall be unreeled along the sides of or in trenches and carefully placed on sand or earth bottoms. Pulling cables into direct-burial trenches from a fixed reel position will not be permitted, except as required to pull cables through conduits. Where cables cross, a separation of at least 3 inches shall be provided, unless each cable circuit is protected by a nonmetallic conduit sleeve at the crossing. Where single-conductor cable is installed, all 3 phases and the neutral shall be installed in the same sleeve. Bend radius of any cable shall be not less than 12 times the diameter of the cable. In no case shall cables be left under longitudinal tension. The first 6 inch layer of backfill shall be of

sand. Machine compaction shall not be used within 6 inches of the cable.

3.2.3.3 Other Requirements

Where direct-burial cables cross under roads or other paving exceeding 5 feet in width, such cables shall be installed in concrete-encased ducts. Ducts shall extend at least 1 foot beyond each edge of any paving. Cables may be pulled into duct from a fixed reel where suitable rollers are provided in the trench. Where direct burial cable transitions to duct-enclosed cable, direct-burial cables shall be centered in duct entrances, and a waterproof nonhardening mastic compound shall be used to facilitate such centering.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to that of the associated cable.

3.4 DUCT LINES

3.4.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used.

3.4.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.4.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement

shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

3.4.4 Nonencased Direct-Burial

Top of duct lines shall be not less than 24 inches below finished grade and shall be installed with a minimum of 3 inches of earth around each duct, except that between adjacent electric power and communication ducts, 12 inches of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a 3 inch layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least 6 inches. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Duct banks may be held in alignment with earth.

3.4.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.4.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose.

3.5.1 Concrete Pads

3.5.1.1 Construction

Concrete pads for pad-mounted electrical equipment shall be poured-in-place. Pads shall be constructed as indicated, except that exact

pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project 4 inches above finished grade and sloped to drain. Edges of concrete pads shall have 3/4 inch chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.5.1.2 Concrete and Reinforcement

Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section 03200 CONCRETE REINFORCEMENT.

3.5.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.6 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to the poles by 2-hole galvanized steel pipe straps spaced not more than 10 feet apart and with 1 strap not more than 12 inches from any bend or termination. Conduits shall be equipped with bushings to protect cables and minimize water entry. Cables shall be supported by devices separate from the conduit, near their point of exit from the conduit or guard.

3.6.1 Pole Installation

Pole installation shall be in accordance with Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

3.7 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2 feet below finished grade as specified and provided under Section 16415 ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

3.8 GROUNDING

A ground ring consisting of the indicated configuration of bare copper

conductors and driven ground rods shall be installed around pad-mounted equipment as shown. Equipment frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, and metallic conduit shall be grounded. At least 2 connections shall be provided from a transformer or switchgear to the ground ring.

3.8.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- b. Ground ring - A ground ring shall be installed as shown consisting of bare copper conductors installed 12 inches, plus or minus 3 inches, below finished top of soil grade. Ground ring conductors shall be sized as shown.
- c. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors as indicated to achieve the specified ground resistance. The additional electrodes will be up to three, 10 feet rods spaced a minimum of 10 feet apart.

3.8.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process.

3.8.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.8.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.8.5 Riser Pole Grounding

A single continuous vertical grounding electrode conductor shall be installed on each riser pole and connected directly to the grounding electrodes indicated on the drawings or required by these specifications. All equipment, neutrals, surge arresters, and items required to be grounded shall be connected directly to this vertical conductor. The grounding

electrode conductor shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet.

3.9 FIELD TESTING

3.9.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 5 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.9.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.9.3 Ground-Resistance Tests

The resistance of each grounding electrode, each grounding electrode system, the ground mat, the ground ring shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Multiple rod electrodes - 25 ohms.
- c. Ground ring - 25 ohms.

3.9.4 Medium-Voltage Cable Test

After installation and before the operating test or connection to an existing system, the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors as one terminal and connecting grounds or metallic shieldings or sheaths of the cable as the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test shall be conducted with all splices, connectors, and terminations in place. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 7 or NEMA WC 8 for the particular type of cable installed, except that 28 kV and 35 kV insulation test voltages shall be in accordance

with either AEIC CS5 or AEIC CS6 as applicable, and shall not exceed the recommendations of IEEE Std 404 for cable joints and IEEE Std 48 for cable terminations unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.9.5 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

3.9.6 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's specifications.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.
- c. Correct phase sequence.
- d. Correct operation of tap changer.

3.9.7 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of 2 years of current product experience. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to ensure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage caused during installation or shipment to ensure packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and

tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

- a. Pad-mounted transformers
- b. Metal-enclosed switchgear
- c. Switches

3.9.8 Operating Tests

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.10 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL
 - 1.2.1 Rules
 - 1.2.2 Coordination
 - 1.2.3 Special Environments
 - 1.2.3.1 Weatherproof Locations
 - 1.2.3.2 Hazardous Locations
 - 1.2.3.3 Ducts, Plenums and Other Air-Handling Spaces
 - 1.2.4 Standard Products
 - 1.2.5 NAMEPLATES
 - 1.2.5.1 Identification Nameplates
 - 1.2.6 As-Built Drawings
- 1.3 SUBMITTALS
- 1.4 WORKMANSHIP

PART 2 PRODUCTS

- 2.1 CABLES AND WIRES
 - 2.1.1 Aluminum Conductors
 - 2.1.2 Insulation
 - 2.1.3 Bonding Conductors
 - 2.1.4 Service Entrance Cables
 - 2.1.5 Cord Sets and Power-Supply Cords
- 2.2 TRANSIENT VOLTAGE SURGE PROTECTION
- 2.3 CIRCUIT BREAKERS
 - 2.3.1 MOLDED-CASE CIRCUIT BREAKERS
 - 2.3.1.1 Construction
 - 2.3.1.2 Ratings
 - 2.3.1.3 Thermal-Magnetic Trip Elements
 - 2.3.2 HACR Circuit Breakers
 - 2.3.3 Ground Fault Circuit Interrupters
- 2.4 CONDUIT AND TUBING
 - 2.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)
 - 2.4.2 Electrical Plastic Tubing and Conduit
 - 2.4.3 Flexible Conduit, Steel and Plastic
 - 2.4.4 Intermediate Metal Conduit
 - 2.4.5 PVC Coated Rigid Steel Conduit
 - 2.4.6 Rigid Aluminum Conduit
 - 2.4.7 Rigid Metal Conduit
 - 2.4.8 Rigid Plastic
- 2.5 CONDUIT AND DEVICE BOXES AND FITTINGS
 - 2.5.1 Boxes, Metallic Outlet
 - 2.5.2 Boxes, Outlet for Use in Hazardous (Classified) Locations
 - 2.5.3 Boxes, Switch (Enclosed), Surface-Mounted

- 2.5.4 Fittings for Conduit and Outlet Boxes
- 2.5.5 Fittings For Use in Hazardous (Classified) Locations
- 2.5.6 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing
- 2.6 CONDUIT COATINGS PLASTIC RESIN SYSTEM
- 2.7 CONNECTORS, WIRE PRESSURE
 - 2.7.1 For Use With Copper Conductors
- 2.8 ELECTRICAL GROUNDING AND BONDING EQUIPMENT
 - 2.8.1 Ground Rods
- 2.9 ENCLOSURES
 - 2.9.1 Cabinets and Boxes
 - 2.9.2 Circuit Breaker Enclosures
- 2.10 FIXTURES, LIGHTING AND FIXTURE ACCESSORIES/COMPONENTS
 - 2.10.1 Fixture, Auxiliary or Emergency
 - 2.10.2 Incandescent Fixture
 - 2.10.3 Fluorescent
 - 2.10.4 High-Intensity-Discharge
- 2.11 MOTORS, AC, FRACTIONAL AND INTEGRAL
 - 2.11.1 Rating
 - 2.11.2 Motor Efficiencies
- 2.12 MOTOR CONTROLS
 - 2.12.1 General
 - 2.12.2 Motor Starters
 - 2.12.3 Thermal-Overload Protection
- 2.13 PANELBOARDS
- 2.14 RECEPTACLES
 - 2.14.1 Hospital Grade
 - 2.14.2 Heavy Duty Grade
 - 2.14.3 Standard Grade
 - 2.14.4 Ground Fault Interrupters
 - 2.14.5 Hazardous (Classified) Locations
- 2.15 Service Entrance Equipment
- 2.16 SPLICE, CONDUCTOR
- 2.17 SNAP SWITCHES
- 2.18 TAPES
 - 2.18.1 Plastic Tape
- 2.19 TRANSFORMERS
 - 2.19.1 Transformers, Dry-Type
- 2.20 WIRING DEVICES
- 2.21 POWER LINE CONDITIONERS

PART 3 EXECUTION

- 3.1 GROUNDING
 - 3.1.1 Ground Rods
 - 3.1.2 Grounding Conductors
- 3.2 WIRING METHODS
 - 3.2.1 Conduit and Tubing Systems
 - 3.2.1.1 Pull Wires
 - 3.2.1.2 Conduit Stub-Ups
 - 3.2.1.3 Below Slab-on-Grade or in the Ground
 - 3.2.1.4 Installing in Slabs Including Slabs on Grade
 - 3.2.1.5 Changes in Direction of Runs
 - 3.2.1.6 Supports
 - 3.2.1.7 Exposed Raceways
 - 3.2.1.8 Communications Raceways
 - 3.2.2 Cables and Conductors
 - 3.2.2.1 Sizing
 - 3.2.2.2 Cable Splicing
 - 3.2.2.3 Conductor Identification and Tagging

- 3.3 BOXES AND SUPPORTS
 - 3.3.1 Box Applications
 - 3.3.2 Brackets and Fasteners
 - 3.3.3 Mounting in Walls, Ceilings, or Recessed Locations
 - 3.3.4 Installation in Overhead Spaces
- 3.4 DEVICE PLATES
- 3.5 RECEPTACLES
 - 3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt
 - 3.5.2 Clock Outlet
 - 3.5.3 Weatherproof Applications
 - 3.5.3.1 Damp Locations
 - 3.5.3.2 Wet Locations
- 3.6 WALL SWITCHES
- 3.7 SERVICE EQUIPMENT
- 3.8 PANELBOARDS
 - 3.8.1 Panelboards
- 3.9 UNDERGROUND SERVICE
- 3.10 MOTORS
- 3.11 MOTOR CONTROL
 - 3.11.1 Contacts
- 3.12 MOTOR-DISCONNECT MEANS
- 3.13 TRANSFORMER INSTALLATION
- 3.14 LAMPS AND LIGHTING FIXTURES
 - 3.14.1 Lamps
 - 3.14.1.1 Incandescent
 - 3.14.1.2 Fluorescent
 - 3.14.1.3 High-Intensity-Discharge
 - 3.14.2 Fixtures
 - 3.14.2.1 Accessories
 - 3.14.2.2 Suspended Fixtures
 - 3.14.2.3 Ceiling Fixtures
 - 3.14.2.4 Sockets
 - 3.14.3 Emergency Light Sets
- 3.15 EQUIPMENT CONNECTIONS
 - 3.15.1 Motors and Motor Control
 - 3.15.2 Installation of Government-Furnished Equipment
- 3.16 PAINTING AND FINISHING
- 3.17 REPAIR OF EXISTING WORK
- 3.18 FIELD TESTING
 - 3.18.1 Safety
 - 3.18.2 Ground-Resistance Tests
 - 3.18.3 Cable Tests
 - 3.18.3.1 Low Voltage Cable Tests
 - 3.18.4 Dry-Type Transformer Tests
 - 3.18.5 Circuit Breaker Tests
 - 3.18.5.1 Circuit Breaker Tests, Medium Voltage
 - 3.18.5.2 Circuit Breakers, Molded Case
- 3.19 OPERATING TESTS
- 3.20 ACCEPTANCE

-- End of Section Table of Contents --

SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|------------|---|
| ANSI C80.5 | (1995) Rigid Aluminum Conduit |
| ANSI C82.1 | (1985; C82.1a; C82.1b; C82.1c; R 1992) Specifications for Fluorescent Lamp Ballasts |
| ANSI C82.4 | (1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type) |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|---|
| ASTM B 1 | (1990) Hard-Drawn Copper Wire |
| ASTM B 8 | (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft |
| ASTM D 709 | (1992) Laminated Thermosetting Materials |

CODE OF FEDERAL REGULATIONS (CFR)

- | | |
|-----------|--|
| 47 CFR 18 | Industrial, Scientific, and Medical Equipment |
|-----------|--|

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- | | |
|-------------|---|
| IEEE C62.41 | (1991) Surge Voltages in Low-Voltage AC Power Circuits |
| IEEE Std 81 | (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|-----------|--|
| NEMA 250 | (1991) Enclosures for Electrical Equipment (1000 Volts Maximum) |
| NEMA AB 1 | (1993) Molded Case Circuit Breakers and Molded Case Switches |

| | |
|------------|--|
| NEMA ICS 1 | (1993) Industrial Control and Systems |
| NEMA ICS 2 | (1993) Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC |
| NEMA ICS 3 | (1993) Industrial Control and Systems Factory Built Assemblies |
| NEMA ICS 6 | (1993) Industrial Control and Systems Enclosures |
| NEMA LE 4 | (1987) Recessed Luminaires, Ceiling Compatibility |
| NEMA MG 1 | (1993; Rev 1; Rev 2; Rev 3) Motors and Generators |
| NEMA MG 10 | (1994) Energy Management Guide for Selection and Use of Polyphase Motors |
| NEMA OS 1 | (1989) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports |
| NEMA PB 1 | (1990) Panelboards |
| NEMA RN 1 | (1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit |
| NEMA ST 20 | (1992) Dry-Type Transformers for General Applications |
| NEMA TC 2 | (1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80) |
| NEMA WD 1 | (1983; R 1989) General Requirements for Wiring Devices |
| NEMA WD 6 | (1988) Wiring Devices - Dimensional Requirements |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|--|
| NFPA 70 | (1996) National Electrical Code |
| NFPA 101 | (1997) Safety to Life from Fire in Buildings and Structures |

UNDERWRITERS LABORATORIES (UL)

| | |
|-------|---|
| UL-03 | (1996; Supple) Electrical Construction Materials Directory |
| UL 1 | (1993; Rev thru Jan 1995) Flexible Metal Conduit |

| | |
|---------|---|
| UL 6 | (1993; Rev Mar 1996) Rigid Metal Conduit |
| UL 20 | (1995; Rev thru Apr 1997) General-Use Snap Switches |
| UL 50 | (1995; Rev Oct 1996) Enclosures for Electrical Equipment |
| UL 67 | (1993; Rev thru Dec 1993) Panelboards |
| UL 83 | (1996) Thermoplastic-Insulated Wires and Cables |
| UL 98 | (1994; R Oct 1995) Enclosed and Dead-Front Switches |
| UL 360 | (1996; Rev Mar 1997) Liquid-Tight Flexible Steel Conduit |
| UL 467 | (1993; Rev thru Aug 1996) Grounding and Bonding Equipment |
| UL 486A | (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors |
| UL 486C | (1997) Splicing Wire Connectors |
| UL 486E | (1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors |
| UL 489 | (1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures |
| UL 498 | (1996) Attachment Plugs and Receptacles |
| UL 506 | (1994; Rev Jul 1994) Specialty Transformers |
| UL 508 | (1993) Industrial Control Equipment |
| UL 510 | (1994) Insulating Tape |
| UL 514A | (1996) Metallic Outlet Boxes |
| UL 514B | (1996) Fittings for Conduit and Outlet Boxes |
| UL 514C | (1996) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers |
| UL 542 | (1994; Rev May 1997) Lampholders, Starters, and Starter Holders for Fluorescent Lamps |
| UL 651 | (1995; Rev Jan 1997) Schedule 40 and 80 Rigid PVC Conduit |

| | |
|---------|---|
| UL 651A | (1995; Rev Sep 1996) Type EB and A Rigid PVC Conduit and HDPE Conduit |
| UL 674 | (1994; Rev thru Feb 1997) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations |
| UL 698 | (1995; Rev thru Dec 1996) Industrial Control Equipment for Use in Hazardous (Classified) Locations |
| UL 797 | (1993; Rev thru Mar 1997) Electrical Metallic Tubing |
| UL 817 | (1994; Rev thru Feb 1997) Cord Sets and Power-Supply Cords |
| UL 844 | (1995; Rev thru Aug 1996) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations |
| UL 845 | (1995; Rev Feb 1996) Motor Control Centers |
| UL 854 | (1996; Rev May 1996) Service-Entrance Cables |
| UL 869A | (1993; Rev Apr 1994) Reference Standard for Service Equipment |
| UL 886 | (1994; Rev thru Jan 1997) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations |
| UL 924 | (1995; Rev thru May 95) Emergency Lighting and Power Equipment |
| UL 935 | (1995; Rev thru Apr 1997) Fluorescent-Lamp Ballasts |
| UL 943 | (1993; Rev thru Mar 1997) Ground-Fault Circuit Interrupters |
| UL 1004 | (1994; Rev thru Feb 1997) Electric Motors |
| UL 1010 | (1995; Rev thru Dec 1996) Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations |
| UL 1029 | (1994; Rev Sep 1995) High-Intensity-Discharge Lamp Ballasts |
| UL 1242 | (1996) Intermediate Metal Conduit |
| UL 1449 | (1985; Errata Apr 1986) Transient Voltage Surge Suppressors |
| UL 1570 | (1995) Fluorescent Lighting Fixtures |

| | |
|---------|--|
| UL 1571 | (1991; Rev thru Mar 95) Incandescent Lighting Fixtures |
| UL 1572 | (1995; Rev thru Sep 96) High Intensity Discharge Lighting Fixtures |
| UL 1660 | (1994) Liquid-Tight Flexible Nonmetallic Conduit |

1.2 GENERAL

1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated herein or shown.

1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible.

Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate electrical work with the HVAC and electrical drawings and specifications and provide power related wiring.

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

1.2.3.2 Hazardous Locations

Wiring and equipment in locations indicated shall be of the classes, groups, divisions, and suitable for the operating temperature; as indicated.

1.2.3.3 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70 unless more stringent requirements are indicated in this specification or on the contract drawings.

1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.2.5 NAMEPLATES

1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch
High Letters

Minimum 1/8 inch
High Letters

Panelboards
Starters
Safety Switches
Transformers
Equipment Enclosures

Control Power Transformers
Control Devices

Each panel, section, or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish two sets of as-built drawings to the Contracting Officer.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

Manufacturer's Catalog; GA

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; FIO

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures; GA

Installation procedures for rotating equipment, transformers. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

SD-04 Drawings

Interior Electrical Equipment; GA

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

- a. Transformers.
- b. Single line electrical diagrams.
- c. Sway bracing for suspended luminaires.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal

wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

As-Built Drawings; GA.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-08 Statements

On-Site Test; GA.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-09 Reports

Factory Test Reports; GA.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.

- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Field Test Plan; GA.

A detailed description of the Contractor's proposed procedures for on-site test submitted 30 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; GA.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.
- h. Final position of controls and device settings.

SD-13 Certificates

Materials and Equipment; GA.

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and

Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. All conductors shall be copper.

2.1.1 Aluminum Conductors

Aluminum conductors shall not be used.

2.1.2 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.1.3 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.1.4 Service Entrance Cables

Service entrance (SE) and underground service entrance (USE) cables, UL 854.

2.1.5 Cord Sets and Power-Supply Cords

UL 817.

2.2 TRANSIENT VOLTAGE SURGE PROTECTION

Transient voltage surge suppressors shall be provided as indicated. Surge suppressors shall meet the requirements of IEEE C62.41 and be UL listed and labeled as having been tested in accordance with UL 1449. Surge suppressor ratings shall be 150 volts rms, operating voltage; 60 Hz; 1-phase; 3 wire with ground; transient suppression voltage (peak let-through voltage) of 460 volts. Fuses shall not be used as surge suppression.

2.3 CIRCUIT BREAKERS

2.3.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers may be installed in panelboards, or enclosures.

2.3.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper and aluminum conductors in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

2.3.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

2.3.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers on frame sizes above 225 amperes.

2.3.2 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

2.3.3 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.4 CONDUIT AND TUBING

2.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

2.4.2 Electrical Plastic Tubing and Conduit

NEMA TC 2.

2.4.3 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660.

2.4.4 Intermediate Metal Conduit

UL 1242.

2.4.5 PVC Coated Rigid Steel Conduit

NEMA RN 1.

2.4.6 Rigid Aluminum Conduit

ANSI C80.5 and UL 6.

2.4.7 Rigid Metal Conduit

UL 6.

2.4.8 Rigid Plastic

NEMA TC 2, UL 651 and UL 651A.

2.5 CONDUIT AND DEVICE BOXES AND FITTINGS

2.5.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514C.

2.5.2 Boxes, Outlet for Use in Hazardous (Classified) Locations

UL 886.

2.5.3 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.5.4 Fittings for Conduit and Outlet Boxes

UL 514B.

2.5.5 Fittings For Use in Hazardous (Classified) Locations

UL 886.

2.5.6 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.6 CONDUIT COATINGS PLASTIC RESIN SYSTEM

NEMA RN 1, Type A-40.

2.7 CONNECTORS, WIRE PRESSURE

2.7.1 For Use With Copper Conductors

UL 486A.

2.8 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.8.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

2.9 ENCLOSURES

NEMA ICS 6 or NEMA 250 or UL 698 for use in hazardous (classified) locations, unless otherwise specified.

2.9.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.9.2 Circuit Breaker Enclosures

UL 489.

2.10 FIXTURES, LIGHTING AND FIXTURE ACCESSORIES/COMPONENTS

Standard Drawing 40-06-04 sheets referenced hereinafter and enclosed as an integral part of these specifications, additional fixtures shown on contract drawings, if any, and UL 844 for fixtures to be installed in hazardous (classified) locations. Fixtures, accessories and components, including ballasts, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

2.10.1 Fixture, Auxiliary or Emergency

UL 924.

2.10.2 Incandescent Fixture

NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1571.

2.10.3 Fluorescent

- a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1570. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles.

b. Ballasts:

(1) Magnetic ballast, energy-saving, high power factor, Class P, automatic-resetting Type, approved for the application by the Certified Ballast Manufacturers: ANSI C82.1 and UL 935. Two-lamp ballasts shall be used for each pair of lamps within a fixture or within continuous mounted fixtures. Single-lamp ballasts shall be used for individually mounted single-lamp fixtures and where an odd single-lamp fixture occurs at the end of a continuous group. Magnetic fluorescent lamp ballasts shall have a Ballast Efficacy Factor (BEF) not less than shown in the following table:

MAGNETIC FLUORESCENT BALLAST EFFICACY FACTORS*

Design starting temperature above 40 degrees F with 60 Hz input frequency

| NUMBER OF LAMPS | LAMP TYPE | NOMINAL OPERATIONAL INPUT VOLTAGE | MAX. LAMP OPERATING CURRENT | MIN. BALLAST EFFICACY FACTOR |
|-----------------------|---------------------|---|-----------------------------------|------------------------------------|
| 1 | 4 ft rapid start | 120 or 277 | less than 1000 m amp | 1.805 |
| 2 | 4 ft rapid start | 120 | less than 1000 m amp | 1.060 |
| 2 | 4 ft rapid start | 277 | less than 1000 m amp | 1.050 |

* For ballasts not specifically designed for use with dimming controls

The BEF is calculated using the formula:

BEF = Ballast Factor, (in percent) / Power Input

Where Power Input = Total Wattage of Combined Lamps and Ballasts.

(2) Electronic Ballast. Electronic ballasts shall consist of a rectifier, high frequency inverter, and power control and regulation circuitry. The ballasts shall be UL listed, Class P, with a Class A sound rating and shall contain no PCBs. Ballasts shall meet 47 CFR 18 for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Design shall withstand line transients per IEEE C62.41, Category A. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture, using one, two, three or four lamp ballasts. A single ballast may be used to serve multiple fixtures if they are continuous mounted, factory manufactured for that installation with an integral wireway, and are identically controlled.

(a) Light output regulation shall be +/- 10%.

- (b) Voltage input regulation shall be +/- 10%.
- (c) Lamp current crest factor shall be no more than 1.6.
- (d) Ballast factor shall be not less than 85% nor more than 100%, unless otherwise indicated.
- (e) A 60 Hz filter shall be provided. Flicker shall be no more than 10% with any lamp suitable for the ballast.
- (f) Ballast case temperature shall not exceed 25 degree Celsius rise above 40 degree Celsius ambient, when tested in accordance with UL 935.
- (g) Total harmonic distortion shall be in the range of 10-20%.
- (h) Power factor shall not be less than 0.95.
- (i) Ballasts shall operate at a frequency of 20 kHz or more.
- (j) Operating filament voltage shall be 2.5 to 4.5 volts.
- (k) Warranty. Three year full warranty including a \$10 labor allowance.
- (l) Ballast Efficacy Factor (BEF) shall be in accordance with the following table. Ballasts and lamps shall be matching rapid start or instant start as indicated on the following table. If 32W-F32-T8 lamps and ballasts are used, they must be either all rapid start or all instant start.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS*

| LAMP TYPE | TYPE OF STARTER & LAMP | NOMINAL OPERATIONAL INPUT VOLTAGE | NUMBER OF LAMPS | MIN. BALLAST EFFICACY FACTOR |
|--------------|------------------------------|---|-----------------------|------------------------------------|
| 40W F40 T12 | rapid start | 120 or 277 V | 1 | 2.3 |
| | | | 2 | 1.2 |
| | | | 3 | 0.8 |
| | | | 4 | 0.6 |
| 34W F40 T12 | rapid start | 120 or 277 V | 1 | 2.6 |
| | | | 2 | 1.3 |
| | | | 3 | 1.0 |
| | | | 4 | 0.7 |
| 40W F40 T10 | rapid start | 120 or 277 V | 1 | 2.2 |
| | | | 2 | 1.1 |
| | | | 3 | 0.8 |
| 32W F32 T8 | rapid or instant start | 120 or 277 V | 1 | 2.4 |
| | | | 2 | 1.4 |
| | | | 3 | 1.0 |
| | | | 4 | 0.8 |

*For ballasts not specifically designed for use with dimming controls

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS*

| LAMP TYPE | TYPE OF STARTER & LAMP | NOMINAL OPERATIONAL INPUT VOLTAGE | NUMBER OF LAMPS | MIN. BALLAST EFFICACY FACTOR |
|--------------|------------------------------|---|-----------------------|------------------------------------|
|--------------|------------------------------|---|-----------------------|------------------------------------|

The BEF is calculated using the formula:

BEF = Ballast Factor (in percent) / Power Input

Where Power Input = Total Wattage of Combined Lamps and Ballasts.

c. Lampholders, Starters, and Starter Holders: UL 542.

2.10.4 High-Intensity-Discharge

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1572.

b. Ballasts: ANSI C82.4 for multiple supply types and UL 1029.

2.11 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral horsepower, 500 hp and smaller shall conform to NEMA MG 1 and UL 1004 for motors; NEMA MG 10 for energy management selection of polyphase motors; and UL 674 for use of motors in hazardous (classified) locations.

2.11.1 Rating

The horsepower rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

2.11.2 Motor Efficiencies

All permanently wired polyphase motors of 1 hp or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 1 hp or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Motor Efficiencies

| HP Efficiency | Std. Efficiency | High |
|------------------|-----------------|------|
| 1 | 77.0 | 85.5 |
| 1.5 | 78.5 | 85.5 |
| 2 | 78.5 | 85.5 |
| 3 | 78.5 | 88.5 |
| 5 | 82.5 | 88.5 |
| 7.5 | 84.0 | 90.0 |
| 10 | 85.5 | 90.0 |

Minimum Motor Efficiencies

| Efficiency | HP | Std. Efficiency | High |
|------------|----|-----------------|------|
| | 15 | 85.5 | 91.0 |
| | 20 | 87.5 | 92.0 |
| | 25 | 88.5 | 92.0 |
| | 30 | 88.5 | 92.0 |
| | 40 | 88.5 | 92.0 |
| | 50 | 89.0 | 92.5 |

2.12 MOTOR CONTROLS

2.12.1 General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845.

2.12.2 Motor Starters

Combination starters shall be provided as indicated.

2.12.3 Thermal-Overload Protection

Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

2.13 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

2.14 RECEPTACLES

2.14.1 Hospital Grade

UL 498.

2.14.2 Heavy Duty Grade

NEMA WD 1. Devices shall conform to all requirements for heavy duty receptacles.

2.14.3 Standard Grade

UL 498.

2.14.4 Ground Fault Interrupters

UL 943, Class A or B.

2.14.5 Hazardous (Classified) Locations

UL 1010.

2.15 Service Entrance Equipment

UL 869A.

2.16 SPLICE, CONDUCTOR

UL 486C.

2.17 SNAP SWITCHES

UL 20.

2.18 TAPES

2.18.1 Plastic Tape

UL 510.

2.19 TRANSFORMERS

Single- and three-phase transformers shall have two windings per phase. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers unless otherwise indicated. Three-phase transformers shall be configured with delta-wye windings, except as indicated. "T" connections may be used for transformers rated 15 kVA or below.

2.19.1 Transformers, Dry-Type

Transformers shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation system for transformers rated 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient temperature of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating.

a. 600 Volt or Less Primary:

NEMA ST 20, UL 506, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 3R enclosure.

2.20 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

2.21 POWER LINE CONDITIONERS

A power line conditioner shall be furnished for the signal distribution equipment circuit. The power line conditioner shall be of the ferroresonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioner shall be rated as indicated on the drawings.

PART 3 EXECUTION

3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

3.1.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, 2 additional rods not less than 6 feet on centers, or if sectional type rods are used, 2 additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.1.1.2 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum conduit, rigid zinc-coated steel conduit, rigid plastic conduit, electrical metallic tubing, and intermediate metal conduit. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified. Wire fill in conduits located in Class I or II hazardous areas shall be limited to 25 percent of the cross sectional area of the conduit.

3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be

provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70.

Raceways shall not be installed under furnaces and shall be kept 6 inches away from parallel runs of flues, and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pounds per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire.

3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used 6 inches above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than one inch from the reinforcing steel.

3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

3.2.1.6 Supports

Except where otherwise permitted by NFPA 70, conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.2.1.8 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirements that no length of run shall contain more than two 90-degrees bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated.

Inside radii of bends in conduits of 1 inch size or larger shall not be less than ten times the nominal diameter.

3.2.2 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

3.2.2.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

3.2.2.2 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

- a. Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.

3.2.2.3 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

- a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for three-phase and single-phase low voltage systems shall be as follows:

277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).
120/240-volt, 1-phase: Black and red.

- b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may

be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.

- c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors.

3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways, 4 by 4 inch nominal size and smaller, shall be of the cast-metal hub type when located in normally wet locations, when flush and surface mounted on outside of exterior surfaces, or when located in hazardous areas. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 4 inches square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Large size boxes shall be NEMA 1, or 3R, or as shown. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 1 inch long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall

consist of a minimum 12 inch long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 1/4 inch from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box.

3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of satin finish corrosion resistant steel. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 RECEPTACLES

3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt

Single and duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be

connected to the metal mounting yoke. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

3.5.2 Clock Outlet

Clock outlet, for use in other than a wired clock system, shall consist of an outlet box, a plaster cover where required, and a single receptacle with clock-outlet plate. The receptacle shall be recessed sufficiently within the box to allow the complete insertion of a standard cap, flush with the plate. A suitable clip or support for hanging the clock shall be secured to the top of the plate. Material and finish of the plate shall be as specified in paragraph DEVICE PLATES.

3.5.3 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

3.5.3.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

3.5.3.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. Assemblies which utilize a self-sealing boot or gasket to maintain wet location rating shall be furnished with a compatible plug at each receptacle location and a sign notifying the user that only plugs intended for use with the sealing boot shall be connected during wet conditions.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 120-volt for use on alternating current only.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the enclosed molded-case circuit breaker type with an external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet

metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper.

3.8.1 Panelboards

Panelboards shall be circuit breaker or fusible switch equipped as indicated on the drawings.

3.9 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 5 feet beyond the building wall and 2 feet below finished grade, for interface with the exterior service lateral conduits. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance and terminated in accordance with the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

3.10 MOTORS

Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.11 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly,

provided the devices used are designed for that purpose and have an adequate horsepower rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

3.11.1 Contacts

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with NEMA ICS 2 for rating designation B300.

3.12 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.13 TRANSFORMER INSTALLATION

Three-phase transformers shall be connected only in a delta-wye configuration as indicated except isolation transformers having a one-to-one turns ratio. "T" connections may be used for transformers rated at 15 kVA or below. Dry-type transformers shown located within 5 feet of the exterior wall shall be provided in a weatherproof enclosure.

3.14 LAMPS AND LIGHTING FIXTURES

Ballasted fixtures shall have ballasts which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

3.14.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

3.14.1.1 Incandescent

Incandescent lamps shall be for 125-volt operation unless otherwise indicated.

3.14.1.2 Fluorescent

Fluorescent lamps for magnetic ballasts shall be as indicated and shall be of a type that will not require starter switches. Lamps shall be of the rapid-start type unless otherwise shown or approved. Fluorescent lamps for electronic ballasts shall be as indicated.

3.14.1.3 High-Intensity-Discharge

High-intensity-discharge lamps shall be the high-pressure sodium type unless otherwise indicated, shown, or approved.

3.14.2 Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on Standard Drawing No. 40-06-04, which accompany and form a part of this specification for the types indicated on drawings. Illustrations shown on these sheets are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.14.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

3.14.2.2 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods, or chains 4 feet or longer excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Single unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be 10 feet. Rods shall be of not less than 3/16 inch diameter. Flexible raceway shall be installed to each fixture from an overhead junction box. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

3.14.2.3 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03. Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

3.14.2.4 Sockets

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

3.14.3 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

3.15 EQUIPMENT CONNECTIONS

All wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

3.15.1 Motors and Motor Control

Motors, motor controls, and motor control centers shall be installed in accordance with NFPA 70, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors, motor controls, and motor control centers and terminated.

3.15.2 Installation of Government-Furnished Equipment

Wiring shall be extended to the equipment and terminated.

3.16 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTING, GENERAL.

3.17 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

3.18 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 5 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.18.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.18.2 Ground-Resistance Tests

The resistance of each grounding electrode shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements.

Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.

3.18.3 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

3.18.3.1 Low Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.

3.18.4 Dry-Type Transformer Tests

The following field tests shall be performed on all dry-type transformers.

- a. Insulation resistance test phase-to-ground, each phase.
- b. Turns ratio test.

3.18.5 Circuit Breaker Tests

The following field tests shall be performed on circuit breakers.

3.18.5.1 Circuit Breaker Tests, Medium Voltage

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance tests phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Power factor test.

- e. High-potential test.
- f. Manual and electrical operation of the breaker.

3.18.5.2 Circuit Breakers, Molded Case

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Manual operation of the breaker.

3.19 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.20 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

APPENDIX A - LIGHT FIXTURES

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

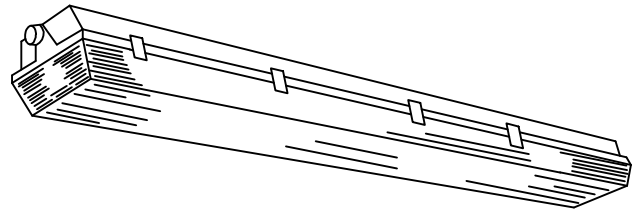
TYPE: PF8

FEATURES

LAMP TYPE: F32T8/75 CRI
PROFILE: 2 LAMP
SHIELDING: STIPPLED ACRYLIC
BALLAST: ELECTRONIC

OPTIONS

PROFILE: 1 LAMP
MOUNTING: SURFACE
BALLAST: HIGH POWER FACTOR
MAGNETIC



NOM. DIMENSIONS 152 mm X 203 mm X 1270 mm
(6" H X 8" W X 50" L)

SPECIFICATIONS

HOUSING: MOLDED HIGH-IMPACT POLYESTER OR FIBERGLASS REINFORCED
PLASTIC WITH COLD ROLLED STEEL INTERIOR COMPONENTS

REFLECTORS: INTERNAL WHITE REFLECTOR

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: WHITE PAINTED

OTHER: UL LISTED FOR WET LOCATION

PENDANT MOUNTED 4' SEALED AND
GASKETED INDUSTRIAL FLUORESCENT

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SF11

FEATURES

LAMP TYPE: F18DTT/RS
PROFILE: 1 LAMP
SHIELDING: CLEAR GLASS GLOBE
BALLAST: ELECTRONIC

OPTIONS

LAMP TYPE: 90W TB/IF
MOUNTING: PENDANT, ARM MOUNT
ADAPTER
SHIELDING: HEAT RESISTANT
BALLAST: HIGH POWER FACTOR
MAGNETIC

NOM. DIMENSIONS 111 mm X 251 mm
(4 3/8 " DIA. X 9 7/8 " H)

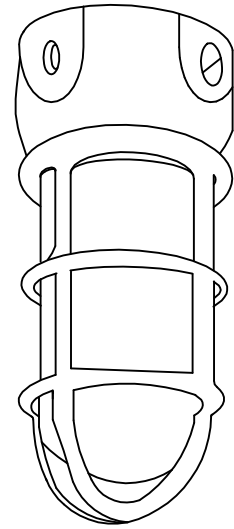
GENERAL DESCRIPTION

HOUSING: 30 PERCENT GLASS-FILLED THERMOPLASTIC POLYESTER

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: MOLDED IN NON-GRAYING FINISH

SURFACE MOUNTED COMPACT FLUORE
VAPOR TIGHT JELLY JAR WITH WIRE (



CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SF12

FEATURES

LAMP TYPE: F18DTT/RS
PROFILE: 1 LAMP
SHIELDING: CLEAR GLASS GLOBE
BALLAST: ELECTRONIC

OPTIONS

LAMP TYPE: 90W TB/IF
MOUNTING: PENDANT, ARM MOUNT
ADAPTER
SHIELDING: HEAT RESISTANT GLASS
BALLAST: HIGH POWER FACTOR
MAGNETIC

NOM. DIMENSIONS 111 mm X 251 mm
(4 3/8 " W X 9 7/8 " H)

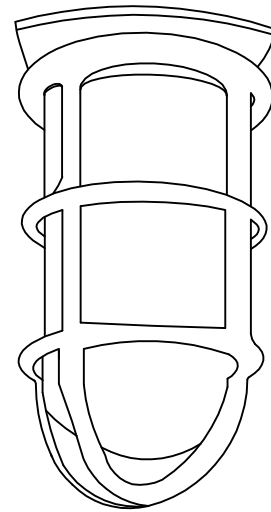
GENERAL DESCRIPTION

HOUSING: 30% GLASS FILLED THERMOPLASTIC POLYESTER

MOUNTING: SURFACE MOUNT ON CONCEALED OUTLET BOX

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: MOLDED IN NON-FADING GRAY OR WHITE FINISH



SURFACE MOUNTED COMPACT FLUORE
VAPOR TIGHT JELLY JAR WITH WIRE
GUARD AND CONCEALED OUTLET BO/

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SF13

FEATURES

LAMP TYPE: F18DTT/RS
PROFILE: 1 LAMP
SHIELDING: GASKETED OPAL
POLYCARBONATE
BALLAST: ELECTRONIC

OPTIONS

LAMP TYPE: 90W TB/IF
MOUNTING: WALL, DUAL BRACKET
BALLAST: HIGH POWER FACTOR
MAGNETIC

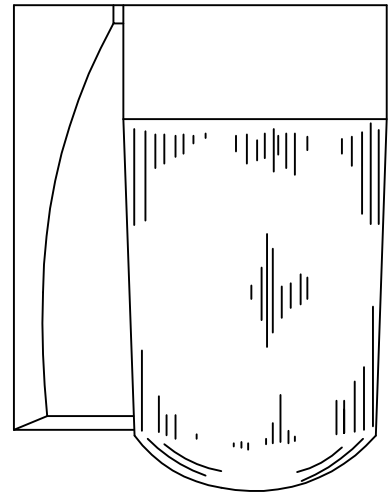
NOM. DIMENSIONS 121 mm X 200 mm
(4 3/4 " DIA. X 7 7/8 " H)

GENERAL DESCRIPTION

HOUSING: DIE CAST ALUMINUM

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: NATURAL ALUMINUM



WALL MOUNTED COMPACT
FLUORESCENT AREA LIGHT

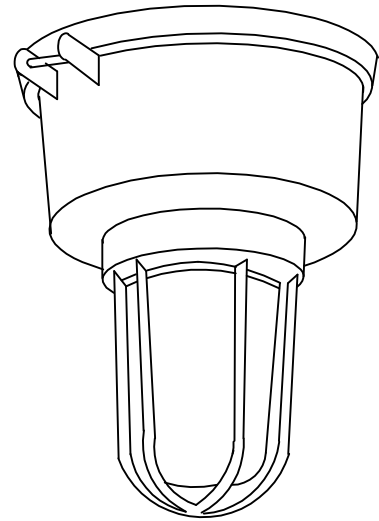
CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SH3

FEATURES

LAMP TYPE: 175W MH
PROFILE: 1 LAMP
SHIELDING: HEAT/IMPACT
RESISTANT RIBBED
GLASS
BALLAST: HIGH POWER FACTOR
MAGNETIC, CORE &
COIL, CWA



OPTIONS

LAMP TYPE: HPS: 150W, 250W, 400W
MH: 250W, 400W
MOUNTING: PENDANT, BRACKET,
STANCHION
SHIELDING: STANDARD DOME, 30
DEGREE DOME

NOM. DIMENSIONS 286 mm X 559 mm
(11 1/4 " DIA. X 22" H)

GENERAL DESCRIPTION

HOUSING: CAST ALUMINUM

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: POWDER COAT PAINT

OTHER: NEC CLASS I, DIV. II, GROUPS C & D; CLASS II, DIV. I &
II GROUPS E, F, G; CLASS III LOCATIONS

SURFACE MOUNTED EXPLOSION PROOF
METAL HALIDE MOGUL BASE JELLY JAR,
CLASS I / DIV II

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

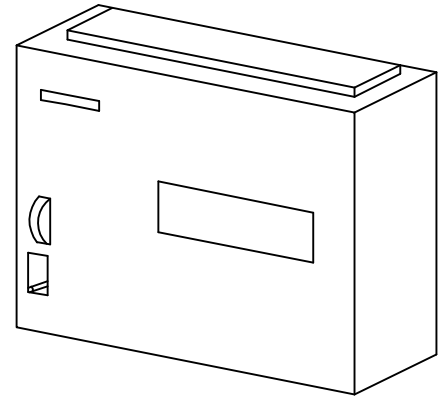
TYPE: X11

FEATURES

BATTERY: SEALED LEAD CALCIUM, 3
YEAR

OPTIONS

BATTERY: SEALED LONG LIFE, 5
YEAR
SEALED NICKEL CADMIUM



NOM. DIMENSIONS 267 mm X 140 mm X 73 mm
(10 1/2 " L X 5 1/2 " H X 2 7/8 " W)

GENERAL DESCRIPTION

HOUSING: COMPACT FIRE-RETARDANT THERMOPLASTIC

MOUNTING: LIGHTING HEADS MOUNTED TOP OR SIDE, WALL-MOUNTED UNIT.

ELECTRICAL: 120 OR 277 VOLT PRIMARY, 6 OR 12 VOLT SECONDARY

FINISH: OFF WHITE

EMERGENCY LIGHTING BATTERY UNIT

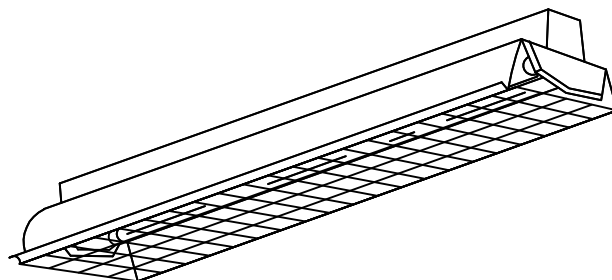
CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: PF6

FEATURES

LAMP TYPE: F32T8/75 CRI
PROFILE: 2 LAMP
SHIELDING: WIRE GUARD
BALLAST: ELECTRONIC



OPTIONS

PROFILE: 3 LAMP
MOUNTING: SURFACE
BALLAST: HIGH POWER FACTOR
MAGNETIC, EMERGENCY

NOM. DIMENSIONS 178 mm X 356 mm X 1219 mm
(7" H X 14" W X 4' L)

GENERAL DESCRIPTION

HOUSING: DIE-FORMED CRS HOUSING WITH ROLLED SYMMETRIC
REFLECTOR/BALLAST COVER

REFLECTORS: COLD ROLLED STEEL, PAINTED WHITE, 10% UPLIGHT APERTURES

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: WHITE ENAMEL POLYESTER POWDER COAT

CHAIN HUNG 4' TURRET
INDUSTRIAL FLUORESCENT

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SF6

FEATURES

LAMP TYPE: F32T8/75 CRI
PROFILE: 2 LAMP
SHIELDING: PRISMATIC LENS
BALLAST: ELECTRONIC

OPTIONS

PROFILE: 3 LAMP
SHIELDING: OPAL WHITE, 3.2 mm
(0.125") PATTERN 12,
PATTERN 19, RFI
SUPPRESSION
BALLAST: HIGH POWER FACTOR
MAGNETIC, DIMMING,
EMERGENCY

NOM. DIMENSIONS 305 mm X 1219 mm X 102 mm
(12" W X 4' L X 4" D)

GENERAL DESCRIPTION

HOUSING: COLD ROLLED STEEL WITH NO VISIBLE HOLES OR KNOCKOUTS;
EXTRUDED ALUMINUM HINGED FRAME AND SPRING-LOADED CATCHES

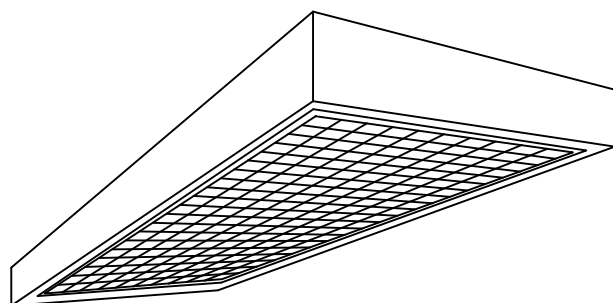
MOUNTING: FIXTURE IS LONGER THAN METRIC GRID

REFLECTORS: GLOSS WHITE

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: BAKED WHITE ENAMEL OR POLYESTER POWDER COAT

EFFICIENCY: 60%



SURFACE MOUNTED LENSED 1'X4' TRO

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SF8

FEATURES

LAMP TYPE: F32T8/75 CRI
PROFILE: 3 LAMP
SHIELDING: PRISMATIC LENS
BALLAST: ELECTRONIC

OPTIONS

PROFILE: 4 LAMP
SHIELDING: OPAL WHITE, 3.2 mm
(0.125") PATTERN 12,
PATTERN 19, RFI
SUPPRESSION
BALLAST: HIGH POWER FACTOR
MAGNETIC, DIMMING,
EMERGENCY

NOM. DIMENSIONS 610 mm X 1219 mm X 102 mm
(24" W X 4' L X 4" D)

GENERAL DESCRIPTION

HOUSING: COLD ROLLED STEEL WITH NO VISIBLE HOLES OR KNOCKOUTS;
EXTRUDED ALUMINUM HINGED LENS FRAME WITH SPRING-LOADED
CATCHES

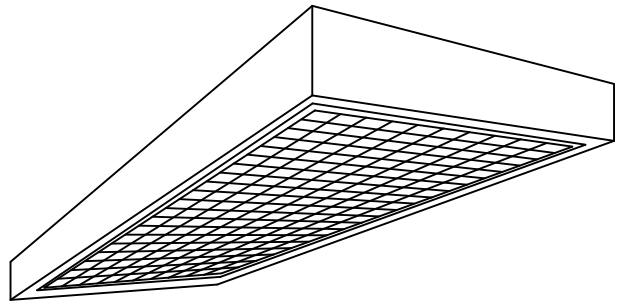
MOUNTING: FIXTURE IS LONGER THAN METRIC GRID

REFLECTORS: GLOSS WHITE

ELECTRICAL: 120 OR 277 VOLT BALLAST

FINISH: BAKED WHITE ENAMEL OR POLYESTER POWDER COAT

EFFICIENCY: 80%



SURFACE MOUNTED LENSED 2'X4'
FLUORESCENT TROFFER

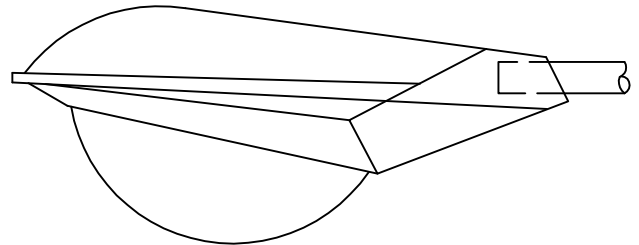
CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: EH2

FEATURES

LAMP TYPE: 250W METAL HALIDE
PROFILE: 1 LAMP
SHIELDING: TEMPERED PRISMATIC
FORMED GLASS
BALLAST: HIGH POWER FACTOR,
CORE & COIL, CWA
OTHER: TYPE I DISTRIBUTION



OPTIONS

LAMP TYPE: MH: 400W
HPS: 250W, 400W
OTHER: TYPE II, III, IV AND V DISTRIBUTIONS.

NOM. DIMENSIONS 699 mm X 292 mm X 337 mm
(27 1/2 " L X 11 1/2 " H X 13 1/4 " W)

GENERAL DESCRIPTION

HOUSING: DIE-CAST ALUMINUM, BOTTOM PLATE HINGED TO TOP OF HOUSING.

MOUNTING: SLIP FITTER TO DAVIT ARM POLE

REFLECTORS: SPECULAR ALUMINUM

ELECTRICAL: 120, 277 OR 480 VOLT BALLAST

FINISH: PAINTED BAKED ENAMEL

POLE MOUNTED METAL HALIDE COBRA HEAD

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

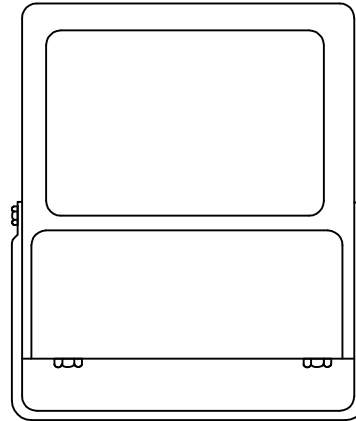
TYPE: EH10

FEATURES

LAMP TYPE: 250W METAL HALIDE
PROFILE: 1 LAMP
SHIELDING: CLEAR TEMPERED GLASS
REFLECTOR: SPECULAR ALUMINUM
BALLAST: HIGH POWER FACTOR,
CORE & COIL, CWA

OPTIONS

LAMP TYPE: MH: 400W
HPS: 250W, 400W
OTHER: GLARE GUARD, MESH GUARD,
POLYCARBONATE SHIELD



NOM. DIMENSIONS 416 mm X 511 mm X 229 mm
(16 3/8 " W X 20 1/8 " L X 9" D)

GENERAL DESCRIPTION

HOUSING: ONE-PIECE DIE-CAST COPPER-FREE ALUMINUM, FULLY GASKETED

MOUNTING: VARIOUS

ELECTRICAL: 120, 277, 208, 240, 347 & 408 VOLT MULTI TAP BALLAST

FINISH: PAINTED DARK BRONZE FINISH

OTHER: NEC CLASS 1, DIV 2

METAL HALIDE HAZARDOUS LOCATION

FLOODLIGHT, CLASS 1/ DIV 2

CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: E12

FEATURES

LAMP TYPE: 500W T3 HALOGEN
PROFILE: 1 LAMP
SHIELDING: CLEAR TEMPERED GLASS

OPTIONS

LAMP TYPE: 300W, 425W, 1500W T3

NOM. DIMENSIONS 241 mm L X 197 mm H X 98 mm
(9 1/2 " L X 7 3/4 " H X 3 7/8 " W)

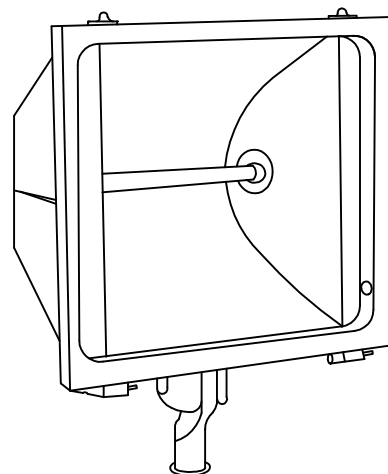
GENERAL DESCRIPTION

HOUSING: CAST ALUMINUM

REFLECTORS: SPECULAR ALUMINUM

ELECTRICAL: 120 VOLT

FINISH: PAINTED DARK BRONZE FINISH



TUNGSTEN HALOGEN FLOODLIGHT

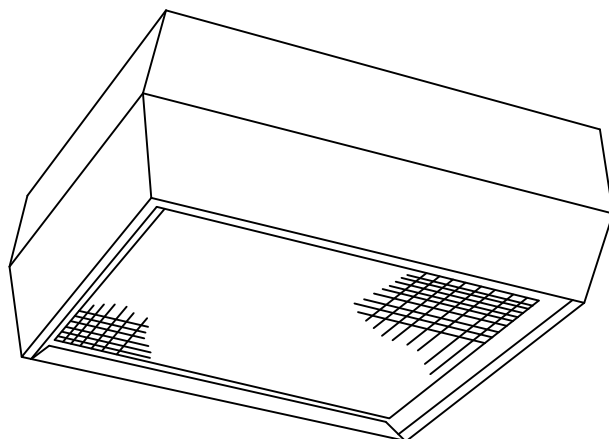
CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

TYPE: SH1

FEATURES

LAMP TYPE: 175W MH
PROFILE: 1 LAMP
SHIELDING: PRISMATIC TEMPERED
GLASS
BALLAST: HIGH POWER FACTOR,
CORE & COIL, CWA



OPTIONS

NOM. DIMENSIONS 610 mm X 610 mm X 356 mm
(24" W X 24" L X 14" D)

GENERAL DESCRIPTION

HOUSING: DIE-FORMED ALUMINUM WITH HINGED LOWER SECTION FOR EASY
RELAMPING AND BALLAST ACCESS; HOUSING SHALL LOCK
TOGETHER SECURELY USING CAPTIVE CLAMPS AND SHALL BE
CONTINUOUSLY GASKETED AGAINST MOISTURE AND INSECTS

MOUNTING: FIXTURE IS LONGER THAN METRIC GRID

REFLECTORS: SEMI-SPECULAR ALUMINUM

ELECTRICAL: 120, 277, 208, 240, 347 & 480 VOLT MULTI TAP BALLAST

FINISH: WHITE ENAMEL OR POLYESTER POWDER COAT

ENCLOSED, INTEGRALLY BALLASTED 2'X2'
METAL HALIDE LUMINAIRE

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16670

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Verification of Dimensions
 - 1.2.2 System Requirements
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 General Requirements
 - 2.1.2 Main and Secondary Conductors
 - 2.1.2.1 Copper
 - 2.1.3 Air Terminals
 - 2.1.4 Ground Rods
 - 2.1.5 Clamp-Type Connectors
 - 2.1.6 Lightning Protection Components

PART 3 EXECUTION

- 3.1 INTEGRAL SYSTEM
 - 3.1.1 General Requirements
 - 3.1.1.1 Air Terminals
 - 3.1.1.2 Roof Conductors
 - 3.1.1.3 Down Conductors
 - 3.1.1.4 Interconnection of Metallic Parts
 - 3.1.1.5 Ground Connections
 - 3.1.1.6 Grounding Electrodes
 - 3.1.2 Steel Frame Building
- 3.2 INSPECTION

-- End of Section Table of Contents --

SECTION 16670

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

NFPA 780 (1992) Lightning Protection Code

UNDERWRITERS LABORATORIES (UL)

UL-03 (1992) Electrical Construction Materials Directory

UL 96 (1985; Rev thru Dec 1988) Lightning Protection Components

UL 96A (1982; Rev thru Jul 1990) Installation Requirements for Lightning Protection Systems

UL 467 (1984; Rev thru Nov 1986) Grounding and Bonding Equipment

UL 486A (1991; R Oct 91) Wire Connectors and Soldering Lugs for Use with Copper Conductors

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Lightning Protection System; GA.

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-13 Certificates

Materials and Equipment; GA

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in UL-03 will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 375 pounds per thousand feet, and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper

conductors not smaller than No. 1/0 AWG.

2.1.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. The tip of air terminals on buildings shall be a minimum of 2 feet above the ridge parapet, ventilator or perimeter. Air terminals more than 24 inches in length shall be supported by a suitable brace, with guides, not less than one-half the height of the terminal.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length.

2.1.5 Clamp-Type Connectors

Connectors for splicing conductors shall conform to UL 96, class as applicable, and UL 486A, Class 2, style and size as required for the installation.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges shall not exceed 25 feet. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as

the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inches. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of ridges, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding flat surfaces shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected where necessary, to prevent mechanical injury to the conductor.

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not

less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 25 ohms, the Contracting Officer will be notified immediately. A counterpoise, where required, shall be of No. 4/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors or their equivalent in the form of metal strips or wires are then buried in the trenches.

3.1.2 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge. Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding. All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground connections to grounding electrons or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than 60 feet.

3.2 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 ENVIRONMENTAL REQUIREMENTS
- 1.4 QUALIFICATIONS
 - 1.4.1 Minimum Contractor Qualifications
 - 1.4.2 Minimum Manufacturer Qualifications
- 1.5 SUBMITTALS
- 1.6 DELIVERY AND STORAGE
- 1.7 OPERATION AND MAINTENANCE MANUALS

PART 2 PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT
- 2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM
 - 2.2.1 Cable Insulation
 - 2.2.2 Horizontal Cable
 - 2.2.3 Connecting Hardware
 - 2.2.3.1 Telecommunications Outlets
 - 2.2.3.2 Terminal Blocks
- 2.3 EQUIPMENT MOUNTING BACKBOARD
- 2.4 TELECOMMUNICATIONS OUTLET BOXES

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Telecommunications Outlets
 - 3.1.1.1 Faceplates
 - 3.1.1.2 Cables
 - 3.1.1.3 Pull Cords
 - 3.1.2 Terminal Blocks
- 3.2 TERMINATION
 - 3.2.1 Unshielded Twisted Pair Cable
- 3.3 GROUNDING
- 3.4 TESTING
 - 3.4.1 Unshielded Twisted Pair Tests
 - 3.4.2 Category 5 Circuits

-- End of Section Table of Contents --

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

| | |
|------------------------|---|
| EIA ANSI/TIA/EIA-568-A | (1995) Commercial Building Telecommunications Cabling Standard |
| EIA ANSI/TIA/EIA-569 | (1990) Commercial Building Standard for Telecommunications Pathways and Spaces |
| EIA ANSI/TIA/EIA-606 | (1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings |
| EIA ANSI/TIA/EIA-607 | (1994) Commercial building Grounding and Bonding Requirements for Telecommunications |
| EIA TSB 67 | (1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---------|---------------------------------|
| NFPA 70 | (1996) National Electrical Code |
|---------|---------------------------------|

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 QUALIFICATIONS

1.4.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. With the exception of furnishing and installing conduit, electrical boxes, and pullwires, this work shall

not be done by the Electrical Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electrical trade staff (electricians) shall not be used for the installation of the premises distribution system cables and associated hardware.
- c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

SD-04 Drawings

Premises Distribution System; GA.

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, and conduits. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Record Drawings; GA.

Record drawings for the installed wiring system infrastructure per EIA ANSI/TIA/EIA-606. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-06 Instructions

Manufacturer's Recommendations; GA.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-08 Statements

Test Plan; GA.

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications; GA.

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-09 Reports

Test Reports; FIO

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on 3-1/2 inch diskettes in ASCII format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 14 days after completion of testing.

SD-13 Certificates

Premises Distribution System; GA

Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-A, EIA ANSI/TIA/EIA-569, and EIA ANSI/TIA/EIA-606 standards.

Materials and Equipment; GA

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized

testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers; GA.

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

SD-18 Records

Record Keeping and Documentation; GA.

Documentation on cables and termination hardware in accordance with EIA ANSI/TIA/EIA-606.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of NFPA 70.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Cable Insulation

For each individual Category 5 cable, the insulation, material used on each pair shall be exactly the same in all physical, electrical, and chemical respects. The use of Teflon insulated, plenum rated Category 5 cable is acceptable for both plenum and non-plenum applications. If Teflon insulated plenum rated cable is used by the Contractor, it shall be Type 4x0, where all four pairs are Teflon insulated. Type 3x1 and 2x2 are not acceptable.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of EIA ANSI/TIA/EIA-568-A for Category 5 horizontal cable. Cable shall be label-verified. Cable jacket

shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMP per NFPA 70.

2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with and EIA ANSI/TIA/EIA-568-A.

2.2.3.1 Telecommunications Outlets

Wall and desk outlet plates shall come equipped with two modular jacks, with the top or left jack labeled "voice" and the bottom or right jack labeled "data". Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of EIA ANSI/TIA/EIA-568-A. Modular jack pin/pair configuration shall be T568A or T568B per EIA ANSI/TIA/EIA-568-A. Modular jacks shall be keyed or unkeyed as shown. Faceplates shall be provided and shall be stainless steel. Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as indicated on the drawings. The modular jacks shall conform to the requirements of EIA ANSI/TIA/EIA-568-A, Category 5.

2.2.3.2 Terminal Blocks

Terminal blocks shall be wall mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 66 which meet the requirements of EIA ANSI/TIA/EIA-568-A for category 5. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or light colored paint.

2.4 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown. Provide a minimum 1 inch conduit.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606. Conduits, outlets and raceways shall be installed in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. Wiring shall be installed in accordance with EIA ANSI/TIA/EIA-568-A and as specified in Section 16415 ELECTRICAL WORK,

INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Telecommunications Outlets

3.1.1.1 Faceplates

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

3.1.1.2 Cables

Unshielded twisted pair and cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.1.1.3 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have fiber optic cable installed.

3.1.2 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in EIA ANSI/TIA/EIA-568-A. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility in accordance with EIA ANSI/TIA/EIA-607 and Section 16415 ELECTRICAL WORK, INTERIOR.

3.4 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required

inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

3.4.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.4.2 Category 5 Circuits

All category 5 circuits shall be tested using a test set that meets the Class II accuracy requirements of EIA TSB 67 standard. Testing shall use the Basic Link Test procedure of EIA TSB 67. Cables which contain failed circuits shall be replaced and retested to verify the standard is met.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 CABLE
 - 2.2.1 Copper Conductor Cable
 - 2.2.1.1 Direct Buried
- 2.3 CONDUIT
- 2.4 PRIMARY DATA CABLE (RETS)
- 2.5 CLOSURES
 - 2.5.1 Copper Conductor Closures
 - 2.5.1.1 Aerial
- 2.6 CABLE TERMINALS
 - 2.6.1 Pedestal-Type Cable Terminals
- 2.7 CABLE SPLICES, CONNECTORS, CABLE ASSEMBLIES, AND ORGANIZERS
 - 2.7.1 Copper Cable Splices
- 2.8 MISCELLANEOUS ITEMS
 - 2.8.1 Shield Connectors
 - 2.8.2 Grounding Braid
 - 2.8.3 Cable Warning Tape
 - 2.8.4 Cable Warning Sign

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Buried Cable
 - 3.1.1.1 Cable Installation
 - 3.1.1.2 Cable Inspection and Repair
 - 3.1.1.3 Cable Depth
 - 3.1.1.4 Above Ground Cable Protection
 - 3.1.1.5 Telephone Cable Bends
 - 3.1.1.6 Penetrations
 - 3.1.1.7 Cable Conduit for Traffic Areas
 - 3.1.1.8 Trenchfill and Backfill for Rocky Soil
 - 3.1.2 Underground Cable
 - 3.1.3 Aerial Cable
 - 3.1.4 Surge Protection
- 3.2 SPLICING
 - 3.2.1 Copper Conductor Splices
- 3.3 GROUNDING
- 3.4 ACCEPTANCE TESTS

3.4.1 Copper Conductor Cable

-- End of Section Table of Contents --

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

RURAL ELECTRIFICATION ADMINISTRATION (REA)

REA Bulletin 1755I-100 (1991; Rev thru Supple 11 Nov 92) List of Materials Acceptable for Use on Telephone System of REA Telephone Borrowers

REA PC-2 (1995) Splicing Copper and Fiber Optic Cables

REA PC-4 (1976) Acceptance Tests and Measurements of Telephone Plant

REA PE-33 (1985) Shield Bonding Connectors

REA PE-39 (1993) REA Specification for Filled Telephone Cables

REA PE-60 (1979) Trunk Carrier Systems

REA TE&CM 635 (1988; Addenda 1 thru 4) Construction of Aerial Cable Plant

REA TE&CM 641 (1973) Construction of Buried Plant

REA TE&CM 644 (1983) Design and Construction of Underground Cable (Physical Plant)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO

Data lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Telephone System; GA

Detail drawings consisting of a complete list of equipment and material including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the cable system has been coordinated and will properly support the switching and transmission systems identified in the specification and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations. System drawings showing final configuration, including the location, gauge, pair, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector blocks layout at the termination points after installation.

SD-08 Statements

Test Plans; FIO

Test plans shall define all tests required to ensure that the system meets specified required. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

SD-09 Reports

Acceptance Tests; FIO

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system.

Installation Procedures; GA.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-13 Certificates

Telephone System; GA

Where materials or equipment are specified to conform to the standards or publications and requirements of FCC, REA, ANSI, ASTM, NFPA, EIA, or UL, proof that the items furnished under this section of the specification conform to the specified requirements.

1.3 DELIVERY AND STORAGE

All cable shall be shipped on reels. The diameter of the drum shall be at least 13 times the diameter of the cable. The reels shall be substantial and so constructed as to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, in such a manner and with sufficient length to make it available for testing. The inner end shall be fastened so as to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Direct Buried

REA PE-39 for cable smaller than 400 pair.

2.3 CONDUIT

Conduit as specified in Section 16415 ELECTRICAL WORK, INTERIOR and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown shall be furnished.

2.4 PRIMARY DATA CABLE (RETS)

Direct-burial data cable will consist of 19 AWG twisted pairs of copper conductors with an overall shield enclosed in a protective insulating sheath. This cable shall conform to REA PE-39. Primary data cable will be number of pairs indicated on the drawings.

2.5 CLOSURES

2.5.1 Copper Conductor Closures

2.5.1.1 Aerial

The aerial closure shall be free breathing and suitable for housing straight, butt, and branch splices of nonpressurized communications cables. The closure shall be constructed from heavy PVC with ultraviolet resistance.

2.6 CABLE TERMINALS

2.6.1 Pedestal-Type Cable Terminals

Pedestal-type cable terminals suitable for use with buried cable distribution systems shall be manufactured from corrosion-resistant aluminum alloy, galvanized steel, or fiberglass material, in an enamel finish. The terminals shall be designed to allow free air circulation, yet prevent rain, snow or dust from entering and damaging the enclosed cable and splices. The terminal cover shall be secured by a locking bolt to prevent unauthorized entry. The base shall be stake-mounted or stand-alone.

2.7 CABLE SPLICES, CONNECTORS, CABLE ASSEMBLIES, AND ORGANIZERS

2.7.1 Copper Cable Splices

Copper cable splices shall consist of a moisture resistant, two- or three-wire connector held rigidly in place to assure maximum continuity. The correct connector size shall be used to accommodate the cable gauge of the cable to be supplied. The connectors used shall be listed in REA Bulletin 1755I-100.

2.8 MISCELLANEOUS ITEMS

2.8.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with REA PE-33.

2.8.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.8.3 Cable Warning Tape

Cable warning tape shall be a minimum of 3 inches wide, orange in color, and suitable for buried applications. The warning tape shall be continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than 48 inches intervals.

2.8.4 Cable Warning Sign

Cable warning sign shall consist of one stake mounted warning sign. The stake shall be driven into undisturbed soil and the sign shall be mounted to the stake in accordance with the manufacturer's instructions.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance

with the manufacturer's instructions and as shown. All necessary interconnections, services, and adjustments required for a complete and operable telephone system shall be provided. All installation work must be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and NFPA 70.

3.1.1 Buried Cable

3.1.1.1 Cable Installation

Buried cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 641.

3.1.1.2 Cable Inspection and Repair

All buried cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.1.3 Cable Depth

Cables shall be placed at a minimum depth of 30 inches. A 3 inch wide plastic warning tape shall be placed approximately 18 inches above the cables and not less than 6 inches from ground level.

3.1.1.4 Above Ground Cable Protection

Cable installed on the outside of buildings within reach of the ground or on the ground outside the buildings and generally accessible to any person, shall be in a protective cover, properly installed with appropriate fittings, bushings, and clamps.

3.1.1.5 Telephone Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter.

3.1.1.6 Penetrations

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. All building entries shall be underground through waterproof facilities.

3.1.1.7 Cable Conduit for Traffic Areas

Where direct buried cable will pass under sidewalks, roads or other paved areas, the cable shall be placed in minimum 3 inch rigid galvanized steel conduit. Conduit may be installed by jacking or trenching. When direct buried cable is to be subject to damage from heavy equipment, the cable shall be placed in minimum 1 inch rigid PVC conduit, a minimum of 42 inches below the surface. Trenches shall be backfilled with earth and mechanically tamped a 6 inch lifts so that the earth is restored to the same grade as adjacent undisturbed material.

3.1.1.8 Trenchfill and Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned

by a fill of sand or selected soil at least 2 inches thick on the floor of the trench before placing the cable or wire. The backfill for at least 4 inches above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 644.

For cable installed in ducts and conduit, a cable feeder guide shall be used between the cable reel, and the face of the duct and conduit to protect the cable and guide it into the duct and conduit as it is payed off the reel. As the cable is payed off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is payed off the reel into the cablefeeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not be such that the cable is twisted or stretched.

3.1.3 Aerial Cable

Aerial cable installation shall be accomplished in accordance with the requirements set forth in REA TE&CM 635.

3.1.4 Surge Protection

All cables and conductors, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meet the requirements of REA PE-60.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with REA PC-2.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded.

3.4 ACCEPTANCE TESTS

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test, and in no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The test plans shall define all the tests required to

ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.4.1 Copper Conductor Cable

The following acceptance tests shall be performed in accordance with REA PC-4:

- a. Shield continuity.
- b. Conductor continuity.
- c. Conductor insulation resistance.
- d. Structural return loss.
- e. Cable insertion loss and loss margin at carrier frequencies.
- f. Shield ground for single jacketed cables.
- g. DC loop resistance.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16721

FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
 - 1.2.1 Standard Products
 - 1.2.2 Nameplates
 - 1.2.3 Keys and Locks
 - 1.2.4 Tags
 - 1.2.5 Verification of Dimensions
 - 1.2.6 Compliance
 - 1.2.7 Manufacturer's Services
- 1.3 SYSTEM DESIGN
 - 1.3.1 Operation
 - 1.3.2 Operational Features
 - 1.3.3 Alarm Functions
 - 1.3.4 Primary Power
 - 1.3.5 Battery Backup Power
- 1.4 SUBMITTALS
- 1.5 DELIVERY AND STORAGE

PART 2 PRODUCTS

- 2.1 CONTROL PANEL
 - 2.1.1 Visual Annunciators
 - 2.1.2 Circuit Connections
- 2.2 STORAGE BATTERIES
- 2.3 BATTERY CHARGER
- 2.4 MANUAL FIRE ALARM STATIONS
- 2.5 FIRE DETECTING DEVICES
 - 2.5.1 Heat Detectors
 - 2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors
- 2.6 NOTIFICATION APPLIANCES
 - 2.6.1 Alarm Horns
 - 2.6.2 Visual Notification Appliances
 - 2.6.3 Combination Audible/Visual Notification Appliances
- 2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT
 - 2.7.1 Conduit
 - 2.7.2 Wiring
 - 2.7.3 Special Tools and Spare Parts

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Power Supply for the System
 - 3.1.2 Wiring
 - 3.1.3 Control Panel

- 3.1.4 Detectors
- 3.1.5 Notification Appliances
- 3.2 OVERVOLTAGE AND SURGE PROTECTION
- 3.3 GROUNDING
- 3.4 TESTING
 - 3.4.1 Preliminary Tests
 - 3.4.2 Acceptance Test

-- End of Section Table of Contents --

SECTION 16721

FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

NFPA 72 (1993) National Fire Alarm Code

NFPA 90A (1993) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL-04 (1994) Fire Protection Equipment Directory

UL 6 (1993) Rigid Metal Conduit

UL 38 (1994; Rev Jan 1994) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

UL 268 (1989; Rev May 1989) Smoke Detectors for Fire Protective Signaling Systems

UL 464 (1990) Audible Signal Appliances

UL 521 (1993) Heat Detectors for Fire Protective Signaling Systems

UL 797 (1993) Electrical Metallic Tubing

UL 864 (1991; Rev thru May 1994) Control Units for Fire-Protective Signaling Systems

UL 1242 (1983; Rev thru Jul 1993) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours.

1.2.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.2.3 Keys and Locks

Locks shall be keyed alike.

1.2.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.6 Compliance

The fire detection and internal alarm system and the central reporting system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.2.7 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, testing, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.3 SYSTEM DESIGN

1.3.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits (IDC), Style D, in accordance with NFPA 72. Alarm indicating appliances shall be connected to indicating appliance circuits (IAC), Style Z in accordance with NFPA 72. A two-loop conduit system shall be provided so that if any one conduit and all conductors contained in that conduit are severed all IDC, IAC, or SLC on that circuit shall remain functional. All textual, audible, and visual

appliances and systems shall comply with NFPA 72.

1.3.2 Operational Features

The system shall have the following operating features:

- a. Electrical supervision of alarm IDC.
- b. Electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel.
- c. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, and removal of alarm zone module (card, PC board). A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.
- d. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the alarm devices will be activated.
- e. Electrical supervision of circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.
- f. Zones shall be arranged as indicated on the contract drawings.

1.3.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Visual indications of the alarmed zones on the fire alarm control panel annunciator.
- b. Continuous sounding of alarm notification appliances throughout the building.
- c. Deactivation of the air handling units throughout the building.

1.3.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.3.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Battery; GA

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop; GA

Voltage drop calculations for signaling appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Spare Parts; FIO

Spare parts data for each different item of material and equipment specified, not later than 2 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Qualifications; FIO

Qualifications, with verification of experience and license number, of a Registered Professional Engineer with at least 4 years of current experience in the design of the fire protection and detection systems. This engineer must perform the various specification items required by this section to be performed by a registered Professional Engineer.

SD-04 Drawings

Fire Alarm Reporting System; GA

Detail drawings, signed by the Registered Professional Engineer, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

Detailed point-to-point wiring diagram, signed by the Registered Professional Engineer, showing all points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated or controlled by the panel.

SD-06 Instructions

Fire Alarm Reporting System; GA.

Six copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. Instructions shall be approved prior to training.

Training; FIO

Lesson plans and training data, in manual format, for the training courses.

SD-08 Statements

Test Procedures; FIO

Detailed test procedures, signed by the Registered Professional Engineer, for the fire detection and alarm system 60 days prior to performing system tests.

SD-09 Reports

Testing; GA

Test reports in booklet form showing all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document all readings, test results and indicate the final position of controls.

SD-13 Certificates

Equipment; GA

Certified copies of current approvals or listings issued by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Installer; GA

The Contractor shall provide documentation demonstrating that its fire detection and alarm system installer has been regularly engaged in the installation of fire detection and alarm systems meeting NFPA standards for a minimum of three years immediately preceding commencement of this contract. Such documentation shall specifically include proof of satisfactory performance on at least three projects similar to that required by these specifications, including the names and telephone numbers of using agency points of contact for each of these projects. Documentation shall indicate the type of each system installed and include a written certificate that each system has performed satisfactorily in the manner specified for a period of not less than 12 months following completion. All such data shall be submitted 30 days prior to commencement of installation for approval of the Contracting Officer. Listing of the

installer under "Protective Signaling Services - Local, Auxiliary, Remote Station Proprietary (UUJS)" of UL-04 shall be accepted as equivalent proof of compliance with the foregoing experience requirements.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with all the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing all components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for all lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble lamp shall be provided for each zone alarm located on exterior of cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meters or lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system.

Each IDC SLC initiating circuit shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including any or all batteries, shall not require the reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

2.1.1 Visual Annunciators

Visual annunciators shall be provided for each active zone and spare zone. Spare zones shall be provided as shown on the drawing. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic or metal sign with either raised or engraved letters. Zone identification shall consist of word description of the zone.

2.1.2 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification.

2.2 STORAGE BATTERIES

Storage Batteries shall be provided and shall be the sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 48 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the

total alarm mode for a minimum period of 15 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours based on a 48 hour discharged rate than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel. Batteries in the control panel shall be located at the bottom of the panel. Battery shall be provided with overcurrent protection in accordance with NFPA 72.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel or battery cabinet.

2.4 MANUAL FIRE ALARM STATIONS

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into alarm-initiating circuits. Stations shall be installed on semi-flush mounted outlet boxes. Stations shall be single action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72, NFPA 90A, UL 268, and UL 521. The detectors shall be provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits. Detectors located in concealed locations (above ceiling, etc.) shall have a remote visible indicator lamp. Installed devices shall conform to the classification of the area.

2.5.1 Heat Detectors

Heat detectors shall be designed for detection of fire by combination fixed temperature and rate-of-rise principle. Heat detectors shall be rated for a minimum of 50 foot spacing (smooth-ceiling rated) in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions or hazardous locations as defined by NFPA 70, shall be types approved for such locations.

2.5.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for semi-flush outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. Detector units located in boiler

rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. Rating for fixed temperature portion shall be 135 degrees F in temperature conditioned spaces.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits and shall have a separate screw terminal for each conductor. Devices shall have manufacturer's standard finish and color.

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box surface mounted single, grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a minimum sound rating of at least 85 dBA at 10 feet. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills.

2.6.2 Visual Notification Appliances

Visual notification appliances shall have high intensity optic lens and flash tubes. Strobes shall flash at approximately 1 flash per second and a minimum of 1 candela (8,000 peak candle power). Strobe shall be surface mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible indicating appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Conduit

Conduit and fittings shall comply with UL 6, UL 1242 and UL 797.

2.7.2 Wiring

Wiring for 120V ac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. 14 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. All conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, supervisory circuits, and alarm indicating circuits are prohibited. T-tapping using screw terminal blocks is allowed for addressable systems.

2.7.3 Special Tools and Spare Parts

Special tools necessary for the maintenance of the equipment shall be

furnished. Two spare fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Fuses and lamps shall be mounted in the fire alarm panel.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power to each building fire alarm system shall be provided. The primary power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors are prohibited in the system. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. All manually operable controls shall be between 36 inches to 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.1.4 Detectors

Detectors shall be installed in accordance with NFPA 72. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location.

3.1.5 Notification Appliances

Notification appliances shall be mounted a minimum of 7-1/2 feet above the finished floor unless limited by ceiling height or otherwise indicated.

3.2 OVERVOLTAGE AND SURGE PROTECTION

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. All cables and conductors which

serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.3 GROUNDING

Grounding shall be provided to building ground.

3.4 TESTING

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

3.4.2 Acceptance Test

Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The test shall include the following:

- a. Test of each function of the control panel.
- b. Test of each circuit in both trouble and normal modes.
- c. Tests of alarm initiating devices in both normal and trouble conditions.
- d. Tests of each control circuit and device.
- e. Tests of each alarm notification appliance.
- f. Tests of the battery charger and batteries.
- g. Complete operational tests under emergency power supply.
- h. Visual inspection of all wiring connections.
- i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
- j. Ground fault
- k. Short circuit faults
- l. Stray voltage

m. Loop resistance

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16725

INTRUSION DETECTION SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 General
 - 1.2.2 Overall System Reliability Requirement
 - 1.2.3 Alarm Classifications
 - 1.2.3.1 Intrusion Alarm
 - 1.2.3.2 Nuisance Alarm
 - 1.2.3.3 Environmental Alarm
 - 1.2.3.4 False Alarm
 - 1.2.4 Probability of Detection
 - 1.2.5 Standard Intruder
 - 1.2.6 Standard Intruder Movement
 - 1.2.7 Electrical Requirements
 - 1.2.8 Power Line Surge Protection
 - 1.2.9 Sensor Wiring and Communication Circuit Surge Protection
 - 1.2.10 System Reaction
 - 1.2.10.1 System Response
 - 1.2.10.2 System Heavy Load Definition
 - 1.2.11 Environmental Conditions
 - 1.2.11.1 Interior, Controlled Environment
 - 1.2.11.2 Interior, Uncontrolled Environment
- 1.3 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE
 - 1.3.1 Group V Technical Data Package
 - 1.3.1.1 Operator's Manual
 - 1.3.1.2 Maintenance Manual
- 1.4 TESTING
 - 1.4.1 General
 - 1.4.2 Test Procedures and Reports
- 1.5 TRAINING
 - 1.5.1 General
- 1.6 LINE SUPERVISION
 - 1.6.1 Signal and Data Transmission Media (DTM) Line Supervision
- 1.7 DATA TRANSMISSION MEDIA (DTM)
- 1.8 EXPERIENCE
 - 1.8.1 Hardware Manufacturer Experience
 - 1.8.2 System Installer Experience
- 1.9 MAINTENANCE AND SERVICE
 - 1.9.1 General Requirements
 - 1.9.2 Description of Work
 - 1.9.3 Personnel
 - 1.9.4 Schedule of Work
 - 1.9.4.1 Minor Inspections
 - 1.9.4.2 Major Inspections
 - 1.9.4.3 Scheduled Work

- 1.9.5 Emergency Service
- 1.9.6 Operation
- 1.9.7 Records and Logs
- 1.9.8 Work Requests
- 1.9.9 System Modifications

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS
 - 2.1.1 Materials and Equipment
 - 2.1.2 Enclosures
 - 2.1.2.1 Interior Sensor
 - 2.1.2.2 Interior Electronics
 - 2.1.2.3 Exterior Electronics
 - 2.1.2.4 Corrosion Resistant
 - 2.1.3 Nameplates
 - 2.1.4 Tamper Provisions
 - 2.1.4.1 Tamper Switches
 - 2.1.4.2 Enclosure Covers
 - 2.1.4.3 Conduit-Enclosure Connections
 - 2.1.5 Locks and Key-Lock Switches
 - 2.1.5.1 Locks
 - 2.1.5.2 Key-Lock-Operated Switches
 - 2.1.5.3 Construction Locks
 - 2.1.6 System Component Design
 - 2.1.6.1 Modularity
 - 2.1.6.2 Maintainability
 - 2.1.6.3 Interchangeability
 - 2.1.6.4 Electromagnetic and Radio Frequency Interference (EMI/RFI)
 - 2.1.6.5 Product Safety
 - 2.1.7 Controls and Designations
 - 2.1.8 Special Test Equipment
 - 2.1.9 Alarm Output
 - 2.1.10 Indicator Lights
 - 2.1.11 Access/Secure Switches
- 2.2 INTERIOR SENSORS
 - 2.2.1 Balanced Magnetic Switch (BMS)
 - 2.2.1.1 BMS Subassemblies
 - 2.2.1.2 Housing
 - 2.2.1.3 Remote Test
 - 2.2.2 Ultrasonic Motion Sensor
 - 2.2.2.1 Test Indicator
 - 2.2.2.2 Remote Test
 - 2.2.3 Siren/Strobe
- 2.3 WIRE AND CABLE
 - 2.3.1 General
 - 2.3.2 Above Ground Sensor Wiring
- 2.4 PREDELIVERY TESTING
 - 2.4.1 General
 - 2.4.2 Test Setup

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Installation
 - 3.1.2 Enclosure Penetrations
 - 3.1.3 Cold Galvanizing
- 3.2 SYSTEM STARTUP
- 3.3 SITE TESTING

- 3.3.1 General
- 3.3.2 Contractor's Field Testing
- 3.3.3 Performance Verification Test

-- End of Section Table of Contents --

SECTION 16725

INTRUSION DETECTION SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2 (1993) National Electrical Safety Code

CODE OF FEDERAL REGULATIONS (CFR)

47 CFR 15 Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 100 (1992) IEEE Standard Dictionary of Electrical and Electronics Terms

IEEE Std 142 (1991) IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

MILITARY HANDBOOKS (MIL-HDBK)

MIL-HDBK 759 (Rev B) Human Factors Engineering Design For Army Materiel

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA ICS 1 (1993) Industrial Controls and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6 (1993) Rigid Metal Conduit

UL 796 (1993) Printed-Wiring Boards

1.2 SYSTEM DESCRIPTION

1.2.1 General

The Contractor shall configure the Intrusion Detection System (IDS) as described and shown including Government Furnished Equipment. All computing devices, as defined in 47 CFR 15, shall be certified to comply with the requirements for Class A computing devices and labeled as set forth in 47 CFR 15. The system shall provide operator interaction and dynamic process manipulation, including overall system supervision, and control. Alarm data shall be obtained from local processors which are located within the protected zone.

1.2.2 Overall System Reliability Requirement

The system, including all components and appurtenances, shall be configured and installed to yield a mean time between failure (MTBF), as defined in IEEE Std 100, of at least 2000 hours continuous operation. Mean time between failure shall be calculated based on the configuration specified in paragraph Overall System Reliability Calculations.

1.2.3 Alarm Classifications

1.2.3.1 Intrusion Alarm

The annunciation of an alarm resulting from the detection of a specified target and which represents an attempt to intrude into the protected area.

1.2.3.2 Nuisance Alarm

The annunciation of an alarm resulting from the detection of an alarm stimuli but which does not represent an attempt to intrude into the protected area.

1.2.3.3 Environmental Alarm

The annunciation of an alarm resulting from environmental conditions which exceed those specified.

1.2.3.4 False Alarm

The annunciation of an alarm when there is no alarm stimuli.

1.2.4 Probability of Detection

Each zone shall have a continuous probability of detection greater than 90 percent and shall be demonstrated with a confidence level of 95 percent. This probability of detection equates to 49 successful detections out of 50 tests or 96 successful detections out of 100 tests. A false alarm rate of less than 1 false alarm per sensor per 5 days shall be provided at this probability of detection.

1.2.5 Standard Intruder

The system shall be able to detect an intruder that has the characteristics of a 5th percentile U.S. Army female as defined in MIL-HDBK 759. The intruder shall be dressed in a long-sleeve shirt, slacks, and shoes unless environmental conditions at the site require protective clothing.

1.2.6 Standard Intruder Movement

Movement of the standard intruder is defined as any movement; such as walking, running, crawling, rolling, and jumping. The system shall detect a standard intruder moving through a protected zone in the most advantageous manner for the intruder.

1.2.7 Electrical Requirements

Electrically powered IDS equipment shall operate on 120 or 240 volt 60 Hz AC sources as shown. Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line frequency of plus or minus 2 percent with no degradation of performance.

1.2.8 Power Line Surge Protection

Equipment connected to alternating current circuits shall be protected from power line surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used for surge protection.

1.2.9 Sensor Wiring and Communication Circuit Surge Protection

Inputs shall be protected against surges induced on sensor wiring. Outputs shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. All communications equipment shall be protected against surges induced on any communications circuit. All cables and conductors, except fiber optics, which serve as communications circuits from the console to field equipment, and between field equipment, shall have surge protection circuits installed at each end. Protection shall be furnished at equipment, and additional triple electrode gas surge protectors rated for the application on each wireline circuit shall be installed within 3 feet of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

- a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.2.10 System Reaction

1.2.10.1 System Response

All alarms shall be annunciated on the console displays within 1 second of their occurring at a local processor. This response time shall be maintained during system heavy load.

1.2.10.2 System Heavy Load Definition

System heavy load conditions are defined as the occurrence of alarms at a rate of 10 alarms per second. For the purpose of system heavy load definition, the system shall consist only of all console equipment and all local processors required by the design. The system heavy load conditions as specified shall have 50 percent of the alarms occurring at a single local processor with the remaining alarms distributed among the remaining

local processors.

1.2.11 Environmental Conditions

1.2.11.1 Interior, Controlled Environment

All system components except the console installed in interior locations having controlled environments shall be rated for continuous operation under ambient environmental conditions of 35 to 120 degrees F dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.2.11.2 Interior, Uncontrolled Environment

All system components installed in interior locations having uncontrolled environments shall be rated for continuous operation under ambient environmental conditions of 0 to 120 degrees F dry bulb and 10 to 95 percent relative humidity, noncondensing.

1.3 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE

All items of computer software and technical data (including technical data which relates to computer software) which is specifically identified in this specification shall be delivered in accordance with the CONTRACT CLAUSES, SPECIAL CLAUSES, Section 01330 SUBMITTAL PROCEDURES, and in accordance with the Contract Data Requirements List (CDRL), DD Form 1423. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished.

1.3.1 Group V Technical Data Package

Final copies of the manuals as specified, bound in hardback loose-leaf binders, shall be delivered to the Government within 30 days after completing the endurance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. The number of copies to be provided shall be as specified on DD Form 1423.

1.3.1.1 Operator's Manual

The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:

- b. System start-up and shutdown procedures.
- c. Use of system, command, and applications software.
- d. Recovery and restart procedures.
- g. Data entry.
- h. Operator commands.

- i. Alarm messages.
- i. System access requirements.

1.3.1.2 Maintenance Manual

The maintenance manual shall describe maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.4 TESTING

1.4.1 General

The Contractor shall perform predelivery testing, site testing, and adjustment of the completed intrusion detection system. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

1.4.2 Test Procedures and Reports

Test procedures shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. Test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test.

1.5 TRAINING

1.5.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the IDS as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional copies delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish all audio-visual equipment and all other training materials and supplies. Where the Contractor presents portions of the course by audio-visual material, copies of the audio-visual material shall be delivered to the Government, either as a part of the printed training manuals or on the same media as that used during the training sessions. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor should assume that attendees will have a high school education or equivalent, and are familiar with intrusion detection systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

1.6 LINE SUPERVISION

1.6.1 Signal and Data Transmission Media (DTM) Line Supervision

All signal or DTM lines between sensors and the alarm annunciation console shall be supervised by the system. The system shall supervise the signal lines by monitoring changes in the direct current that flows through the signal lines and a terminating resistor. The system shall initiate an alarm in response to a current change of 10 percent or greater. The system shall also initiate an alarm in response to opening, closing, shorting, or grounding of the signal and DTM lines.

1.7 DATA TRANSMISSION MEDIA (DTM)

The Contractor shall provide data transmission media systems as specified in Section 16710 PREMISES DISTRIBUTION SYSTEM and as shown.

1.8 EXPERIENCE

The contractor shall submit written proof that the following experience requirements are being met.

1.8.1 Hardware Manufacturer Experience

All system components shall be produced by manufacturers who have been regularly engaged in the production of intrusion detection system components of the types to be installed for at least 5 years.

1.8.2 System Installer Experience

The system shall be installed by a contractor who has been regularly engaged in the installation of intrusion detection systems of similar type and complexity as the specified system for at least 2 years.

1.9 MAINTENANCE AND SERVICE

1.9.1 General Requirements

The Contractor shall provide all services required and equipment necessary to maintain the entire intrusion detection system in an operational state as specified for a period of 1 year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled adjustments or other nonscheduled work.

1.9.2 Description of Work

The adjustment and repair of intrusion detection system includes all computer equipment, software updates, communications transmission equipment and DTM, local processors, and all new IDS sensors and support equipment. Responsibility shall be limited to Contractor installed equipment. The contractor shall provide the manufacturer's required adjustments and all other work necessary.

1.9.3 Personnel

Service personnel shall be certified in the maintenance and repair of similar types of equipment and qualified to accomplish all work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any change in personnel.

1.9.4 Schedule of Work

The Contractor shall perform two minor inspections at 6 month intervals (or

more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.

1.9.4.1 Minor Inspections

These inspections shall include:

- a. Visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, and electrical and mechanical controls.

1.9.4.2 Major Inspections

These inspections shall include all work described under paragraph Minor Inspections and the following work:

- a. Clean all system equipment, local processors, including interior and exterior surfaces.
- b. Perform diagnostics on all equipment.
- c. Check, walk test, and calibrate each sensor.
- d. Run all system software diagnostics and correct all diagnosed problems.
- e. Resolve any previous outstanding problems.

1.9.4.3 Scheduled Work

This work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

1.9.5 Emergency Service

The Government will initiate service calls when the intrusion detection system is not functioning properly. Qualified personnel shall be available to provide service to the complete intrusion detection system. The Government shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within 2 hours after receiving a request for service. The intrusion detection system shall be restored to proper operating condition within 2 hours after service personnel arrive on site.

1.9.6 Operation

Performance of scheduled adjustments and repair shall verify operation of the intrusion detection system as demonstrated by the applicable tests of the performance verification test.

1.9.7 Records and Logs

The Contractor shall keep records and logs of each task, and shall organize cumulative records for each component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the

intrusion detection system.

1.9.8 Work Requests

The Contractor shall separately record each service call request, as received. The form shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within 5 days after work is accomplished.

1.9.9 System Modifications

The Contractor shall make any recommendations for system modification in writing to the Government. No system modifications, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

2.1.1 Materials and Equipment

Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's model and serial number in a conspicuous place.

2.1.2 Enclosures

System enclosures shall be metallic as shown.

2.1.2.1 Interior Sensor

Sensors to be used in an interior environment shall be housed in an enclosure that provides protection against dust, falling dirt, and dripping noncorrosive liquids.

2.1.2.2 Interior Electronics

System electronics to be used in an interior environment shall be housed in enclosures which meet the requirements of NEMA 250 Type 12.

2.1.2.3 Exterior Electronics

System electronics to be used in an exterior environment shall be housed in enclosures which meet the requirements of NEMA 250 Type 4X.

2.1.2.4 Corrosion Resistant

System electronics to be used in a corrosive environment as defined in NEMA 250 shall be housed in metallic enclosure which meet the requirements of NEMA 250 Type 4X.

2.1.3 Nameplates

Laminated plastic nameplates shall be provided for local processors. Each nameplate shall identify the local processor and its location within the system. Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of 1 inch by 3 inches, with minimum 1/4 inch high engraved block lettering. Nameplates shall be attached to the inside of the enclosure housing the local processor. Other major components of the system shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a corrosion resistant plate secured to the item of equipment. Nameplates will not be required for devices smaller than 1 inch by 3 inches.

2.1.4 Tamper Provisions

2.1.4.1 Tamper Switches

Enclosures, cabinets, housings, boxes, and fittings of every description having hinged doors or removable covers and which contain circuits or connections of the intrusion detection system and its power supplies, shall be provided with cover operated, corrosion-resistant tamper switches, arranged to initiate an alarm signal when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and the tamper switch shall function together in such a manner as to not allow direct line of sight to any internal components before the switch activates. Tamper switches shall be inaccessible until the switch is activated; have mounting hardware so concealed that the location of the switch cannot be observed from the exterior of the enclosure; be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating; shall be spring-loaded and held in the closed position by the door or cover; and shall be wired so that they break the circuit when the door or cover is disturbed.

- a. Nonsensor Enclosures: Tamper switches on nonsensor enclosures, which must be opened to make routine maintenance adjustments to the system and to service the power supplies, shall be push/pull-set, automatic reset type.
- b. Sensor Enclosures: Tamper switches on sensor enclosures, which must be opened to make routine maintenance adjustments to the sensor, shall be single pole single throw type.

2.1.4.2 Enclosure Covers

Covers of pull and junction boxes provided to facilitate initial installation of the system need not be provided with tamper switches if they contain no splices or connections, but shall be protected by tack welding or brazing the covers in place. Zinc labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate that the box is part of the intrusion detection system.

2.1.4.3 Conduit-Enclosure Connections

All conduit-enclosure connections shall be protected by tack welding or brazing the conduit to the enclosure. Tack welding or brazing shall be done in addition to standard conduit-enclosure connection methods as described in NFPA 70.

2.1.5 Locks and Key-Lock Switches

2.1.5.1 Locks

Locks required to be installed on system enclosures for maintenance purposes shall be UL listed, round-key type, with three dual, one mushroom, and three plain pin tumblers or conventional key type lock having a combination of five cylinder pin and five-point three position side bar. Keys shall be stamped "U.S. GOVT. DO NOT DUP." The locks shall be so arranged that the key can only be withdrawn when in the locked position. All maintenance locks shall be keyed alike and only two keys shall be furnished for all of these locks. These keys shall be controlled in accordance with the key control plan as specified in paragraph Key Control Plan.

2.1.5.2 Key-Lock-Operated Switches

All key-lock-operated switches required to be installed on system components shall be UL listed, round-key type, with three dual, one mushroom, and three plain pin tumblers or conventional key type lock having a combination of five cylinder pin and five-point three position side bar. Keys shall be stamped "U.S. GOVT. DO NOT DUP." Key-lock-operated switches shall be two position, with the key removable in either position. All key-lock-operated switches shall be keyed differently and only two keys shall be furnished for each key-lock-operated-switch. These keys shall be controlled in accordance with the key control plan as specified in paragraph Key Control Plan.

2.1.5.3 Construction Locks

If the Contractor requires locks during installation and construction, a set of temporary locks shall be used. The final set of locks installed and delivered to the Government shall not include any of the temporary locks.

2.1.6 System Component Design

IDS components shall be designed for continuous operation. Electronic components shall be solid state type, mounted on printed circuit boards conforming to UL 796. Printed circuit board connectors shall be plug-in, quick-disconnect type. Power dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current carrying capacity. Light duty relays and similar switching devices shall be solid state type or sealed electromechanical.

2.1.6.1 Modularity

The Contractor shall provide equipment designed for increase of system capability by installation of component modules. System components shall be designed to facilitate maintenance through replacement of modular subassemblies and parts.

2.1.6.2 Maintainability

Components shall be designed to be maintained using commercially available tools and equipment. Components shall be arranged and assembled so they are accessible to maintenance personnel. There shall be no degradation in tamper protection, structural integrity, EMI/RFI attenuation, or line

supervision after maintenance when it is performed in accordance with manufacturer's instructions. The system shall be configured and installed to yield a mean time to repair (MTTR) of not more than 8 hours. Repair time is the clock time from the time maintenance personnel are given entrance to the IDS and begin work, until the IDS is fully functional.

2.1.6.3 Interchangeability

The system shall be constructed with off-the-shelf components which are physically, electrically and functionally interchangeable with equivalent components as complete items. Replacement of equivalent components shall not require modification of either the new component or of other components with which the replacement items are used. Custom designed or one-of-a-kind items shall not be used. Interchangeable components or modules shall not require trial and error matching in order to meet integrated system requirements, system accuracy, or restore complete system functionality.

2.1.6.4 Electromagnetic and Radio Frequency Interference (EMI/RFI)

IDS components generating EMI/RFI shall be designed and constructed in accordance with 47 CFR 15.

2.1.6.5 Product Safety

IDS components shall conform to applicable rules and requirements of NFPA 70. IDS components, shall be equipped with instruction plates including warnings and cautions, describing physical safety, and special or important procedures to be followed in operating and servicing IDS equipment.

2.1.7 Controls and Designations

Controls and designations shall be as specified in NEMA ICS 1.

2.1.8 Special Test Equipment

The Contractor shall provide all special test equipment, special hardware, software, tools, and programming or initialization equipment needed to start or maintain any part of the system and its components. Special test equipment is defined as any test equipment not normally used in an electronics maintenance facility.

2.1.9 Alarm Output

The alarm output of each sensor shall be a single pole double throw (SPDT) contact rated for a minimum of 0.25 A at 24 volts DC.

2.1.10 Indicator Lights

Indicator lights used throughout the system shall be light emitting diodes (LED) or long life incandescent lamps. The indicator lights used shall be visible from a distance of 30 feet in an area illuminated to 75 foot candles. The indicator lights shall conform to the following color coding:

- a. RED shall be used to alert an operator that a zone is in alarm and that the alarm has been acknowledged.
- b. FLASHING RED shall be used to alert an operator that a zone has gone into an alarm or that primary power has failed.

- c. YELLOW shall be used to advise an operator that a zone is in access.
- d. GREEN shall be used to indicate that a zone is secure or that power is on.

2.1.11 Access/Secure Switches

An access/secure switch shall be used to place a protected zone in ACCESS. The switch shall consist of a double pull key-operated switch housed in a NEMA 12 equivalent enclosure. The switch shall disable all sensor alarm outputs with the exception of tamper alarm outputs within the protected zone and sensors in zones above false ceilings or other inaccessible locations as shown.

2.2 INTERIOR SENSORS

2.2.1 Balanced Magnetic Switch (BMS)

The BMS shall detect a 1/4 inch of separating relative movement between the magnet and the switch housing. Upon detecting such movement, it shall transmit an alarm signal to the alarm annunciation system.

2.2.1.1 BMS Subassemblies

The BMS shall consist of a switch assembly and an actuating magnetic assembly. The switch mechanism shall be of the balanced magnetic type. Each switch shall be provided with an overcurrent protective device, rated to limit current to 80 percent of the switch capacity. Switches shall be rated for a minimum lifetime of one million operations. The magnet assembly shall house the actuating magnet.

2.2.1.2 Housing

The housings of surface mounted switches and magnets shall be made of nonferrous metal and shall be weatherproof. The housings of recess mounted switches and magnets shall be made of nonferrous metal or plastic.

2.2.1.3 Remote Test

A remote test capability shall be provided. The remote test shall be initiated when commanded by the alarm annunciation system. The remote test shall activate the sensor's switch mechanism causing an alarm signal to be transmitted to the alarm annunciation system. The remote test shall simulate the movement of the actuating magnet relative to the switch subassembly.

2.2.2 Ultrasonic Motion Sensor

The ultrasonic motion sensor shall detect doppler shifts in the transmitted ultrasonic signal. An alarm signal shall be transmitted to the alarm annunciation system upon detecting such doppler shifts. The sensor shall detect a standard intruder moving within the sensor's detection pattern at a speed of 0.3 to 7.5 feet per second. The ultrasonic signal shall be in the 25 to 33 KHz range. The sensor's coverage pattern shall be as shown. The sensitivity of the sensor shall be adjustable by controls within the sensor. The controls shall not be accessible when the sensor housing is in place. The sensor shall be adjustable to obtain the coverage shown.

2.2.2.1 Test Indicator

The ultrasonic motion sensor shall be equipped with an LED walk test indicator. The walk test indicator shall not be visible during normal operations. When visible, the walk test indicator shall light when the sensor detects an intruder. The sensor shall either be equipped with a manual control, located within the sensor's housing, to enable/disable the test indicator or the test indicator shall be located within the sensor such that it can only be seen when the housing is open/removed.

2.2.2.2 Remote Test

A remote test capability shall be provided. The remote test hardware may be integral to the sensor or a separate piece of equipment. The remote test shall be initiated when commanded by the alarm annunciation system. The remote test shall excite the sensing element and associated electronics causing an alarm signal to be transmitted to the alarm annunciation system. The sensor stimulation generated by the remote test hardware shall simulate a standard intruder moving within the sensor's detection pattern.

2.2.3 Siren/Strobe

Provide UL listed 30 watt, 8 ohm speaker and siren driver rated for 6 to 12 volts dc and having two distinct sound outputs. Provide siren in a metal enclosed, weather resistant box having tamper switches on front cover and on back of box. Visual notification shall have high intensity optic lens and flash tubes. Strobe shall flash at approximately one flash per second and a minimum of 1 candlelamp (8,000 peak candle power) provide strobe in a surface weather resistant box. All units shall be factory assembled.

2.3 WIRE AND CABLE

2.3.1 General

The Contractor shall provide all wire and cable not indicated as Government furnished equipment. All wiring shall meet NFPA 70 standards.

2.3.2 Above Ground Sensor Wiring

Sensor wiring shall be 20 AWG minimum, twisted and shielded, 2, 3, 4, or 6 pairs to match hardware. Multiconductor wire shall have an outer jacket of PVC.

2.4 PREDELIVERY TESTING

2.4.1 General

The Contractor shall assemble the test IDS as specified, and perform tests to demonstrate that the performance of the system complies with the contract requirements in accordance with the approved predelivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during predelivery testing, including results of each test procedure, shall be delivered to the Government at the conclusion of predelivery testing prior to Government approval of the test. The test report shall be arranged so that all commands, stimuli, and responses are correlated to allow logical interpretation.

2.4.2 Test Setup

The predelivery test setup shall include the following:

- a. All console equipment.
- b. At least one of each type data transmission media (DTM) and associated equipment to provide a fully integrated IDS.
- c. The number of local processors shall equal the amount required by the site design.
- d. Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually or software generated.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components, including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified and shown.

3.1.1 Installation

All wiring, including low voltage wiring outside the console, cabinets, boxes, and similar enclosures, shall be installed in rigid galvanized steel conduit conforming to UL 6. Minimum size of conduit shall be 1/2 inch. Connections shall be tight tapered threaded. No threadless fittings or couplings shall be used. Conduit outlet boxes, pull boxes, junction boxes, conduit fittings and similar enclosures shall be cast metal or malleable iron as specified in Section 16415 ELECTRICAL WORK, INTERIOR, with threaded hubs or bodies. Electric metallic tubing (EMT), armored cable, nonmetallic sheathed cable, or flexible conduit will not be permitted except where specifically shown. DTM shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. Flexible cords or cord connections shall not be used to supply power to any components of the intrusion detection system, except where specifically noted herein. All other electrical work shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR and as shown. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.2 Enclosure Penetrations

All enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with an approved sealant as recommended by the cable manufacturer to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.1.3 Cold Galvanizing

All field welds and/or brazing on factory galvanized components, such as boxes, enclosures, and conduits, shall be coated with a cold galvanized paint containing at least 95 per cent zinc by weight.

3.2 SYSTEM STARTUP

The Contractor shall not apply power to the intrusion detection system until the following items have been completed:

- a. Intrusion detection system equipment items and DTM have been set up in accordance with manufacturer's instructions.
- b. A visual inspection of the intrusion detection system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
- c. System wiring has been tested and verified as correctly connected as indicated.
- d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
- e. Power supplies to be connected to the intrusion detection system have been verified as the correct voltage, phasing, and frequency as indicated.
- f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.3 SITE TESTING

3.3.1 General

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Government will witness all performance verification and endurance testing. Written permission shall be obtained from the Government before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test.

3.3.2 Contractor's Field Testing

The Contractor shall calibrate and test all equipment, verify data transmission media (DTM) operation, place the integrated system in service, and test the integrated system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Government that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.3.3 Performance Verification Test

The Contractor shall demonstrate that the completed IDS complies with the contract requirements. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The performance verification test, as specified, shall not be started until receipt by the Contractor of written permission from the Government, based on the Contractor's written request. This shall include certification of successful completion of testing as specified in paragraph Contractor's Field Testing, and upon successful completion of training as specified. The Government may terminate testing at any time when the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II. Upon successful completion of the performance verification test, the Contractor shall deliver test reports and other documentation, as specified, to the Government prior to commencing the endurance test.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16760

INTERCOMMUNICATION SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Sound Reproduction
 - 1.2.2 System Operation and Service Features
 - 1.2.2.1 Control and Power Requirements
 - 1.2.2.2 Call-In Indication
 - 1.2.2.3 Identification Plates
 - 1.2.2.4 Speaker/Handset Stations
 - 1.2.2.5 Privacy Switch
- 1.3 SUBMITTALS
- 1.4 DELIVERY AND STORAGE
- 1.5 VERIFICATION OF DIMENSIONS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Standard Products
 - 2.1.2 Identical Items
 - 2.1.3 Nameplates
- 2.2 TYPE 1 SYSTEM
 - 2.2.1 Master Station
 - 2.2.2 Intercommunication Amplifier
 - 2.2.3 Remote Station
 - 2.2.4 All-Call Amplifier
- 2.3 TERMINALS
- 2.4 COMMUNICATIONS WIRING
- 2.5 SURGE PROTECTION

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Signal and Control Circuits Wiring
 - 3.1.2 Conduit and Tubing Systems
- 3.2 GROUNDING
- 3.3 ACCEPTANCE TESTS

-- End of Section Table of Contents --

SECTION 16760

INTERCOMMUNICATION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(1996) National Electrical Code

1.2 SYSTEM DESCRIPTION

The system shall be solid state, modular in design, and shall be of the wired type with a single master with remote stations as indicated.

1.2.1 Sound Reproduction

The intercommunication system shall reproduce a signal at all receiving stations from a 40 dB minimum input signal referenced to a microphone sound pressure level (SPL) over the frequency range of 300 to 3300 60 Hz. The received signal shall have a dynamic range of 30 dB, adjustable at the receiving station. Unless otherwise specified SPL shall be 20 micro Paschal. The root-mean-square (rms) extraneous noise (e.g. hum) level introduced by the intercommunication system shall be at least 30 dB below the nominal signal level. Distortion, including envelope delay, intermodulation, cross talk, and other nonlinear sources, shall not exceed 5 percent.

1.2.2 System Operation and Service Features

1.2.2.1 Control and Power Requirements

The system shall have a power switch and an associated pilot light for ON and OFF operations. A volume control at each station shall be used to regulate listening volume. System shall operate on 110-125 Vac, single phase, 60 Hz.

1.2.2.2 Call-In Indication

Master stations shall have a "call-in" switch to provide an audible and/or visual indication of incoming calls from remote stations. Individual visual indication shall identify calling station and status, and remain actuated until a call is answered by a master station.

1.2.2.3 Identification Plates

In addition to the manufacturer's standard identification plates, engraved laminated phenolic identification plates shall be provided for each

component connection and terminal. Identification labels shall be 3-layer black on white on black, engraved to show white letters on a black background. Any warning or caution labels shall be 3-layered red on white on red, engraved to show white letters on red background. Control switches and knobs shall be clearly marked with their function and status. Identification strips for station selector switches shall be located to clearly identify remote stations and shall be protected by transparent plastic inserts.

1.2.2.4 Speaker/Handset Stations

At speaker/handset stations, lifting the handset shall automatically cut out the loudspeaker in the station and all conversation shall be carried through the handset.

1.2.2.5 Privacy Switch

A privacy switch shall be provided at each remote station. When in the ON position, the switch shall prevent any transmission of sound from the remote station. When in the OFF position, without further switch manipulation, the station shall respond to incoming calls upon voice activation from anywhere within a 20 foot radius of station.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO

After approval of detail drawings and not later than 2 months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment and component in the system. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Intercommunication System; GA.

Detail drawings shall consist of illustrations, schedules, performance charts, instructions, brochures, diagrams, catalog cuts, manufacturer's data, materials and equipment lists, and operational and general maintenance instructions. Detail drawings shall be submitted for the overall system and for each major component. Drawings shall illustrate how each item of equipment has been coordinated and will function properly in the system. Detail drawings shall include an overall system schematic indicating relationship of intercommunication units on one diagram and showing power source, system controls, impedance matches, plus number, size, and maximum lengths of interconnecting wires and indicate clearances required for maintenance and operation.

SD-09 Reports

Test Plan and Procedures; GA.

Test plan and procedures for the acceptance test shall explain in detail step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedures shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

Acceptance Tests; GA.

Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria. Each test report shall include the final position of controls and operating mode of the system. The manufacturer, model number, and serial number of test equipment used in each test shall also be included.

SD-19 Operation and Maintenance Manuals

Intercommunication System; GA.

Six complete copies of operation manuals outlining the step-by-step procedures required for system start-up, operation and shutdown. The manuals shall include equipment layout and schematics of simplified wiring and control diagrams of the system as installed. Instructions shall include the manufacturer's name, model number, and a brief description of equipment and components, and their basic operating features.

Six complete copies of maintenance manuals listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.5 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that have been in satisfactory use at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.3 Nameplates

Each major component of equipment shall have the manufacturer's name, model number, and serial number on a plate screwed to the equipment.

2.2 TYPE 1 SYSTEM

Direct connected keyed intercommunication system shall accommodate stations in any combination of master stations and remote stations. Master and remote stations shall be provided in the quantities indicated. Each master station shall selectively communicate with any other master station and remote station by actuation of an appropriate selector switch. Each master station shall be designed to be capable of initiating a message to all remote stations simultaneously or in groups of not less than 10 stations per group.

2.2.1 Master Station

Desk-mounted master stations shall as a minimum conform to the following specifications:

Capacity: Accommodate 20 stations

Speaker Sensitivity: Minimum of 40 dB

2.2.2 Intercommunication Amplifier

The system intercommunication amplifier shall as a minimum conform to the following specifications:

Output Power: 2 watts rms or greater

Total Harmonic Distortion: Less than 5 percent at rated output power with a load equivalent to one station connected to output terminals

Signal-To-Noise Ratio: 60 dB or greater at rated output

Frequency Response: Plus or minus 2 dB from 200 Hz to 10,000 Hz

2.2.3 Remote Station

Surface wall weatherproof-mounted remote station shall have stainless steel faceplate with tamper proof mounting screws and galvanized steel backbox with "station call-in" capabilities. The remote station shall provide a speaker with a minimum sensitivity of 40 dB for speakers less than 8 inches in diameter and 45 dB for speakers 8 inches or greater. The remote station shall have a call announcement monitor lamp and recurring momentary tone.

2.2.4 All-Call Amplifier

All-call amplifier shall as a minimum conform to the following specifications:

| | |
|----------------------------|--|
| Output Power: | Minimum of 0.5 watt rms for each station |
| Total Harmonic Distortion: | Less than 5 percent at rated output power with a load equivalent to the quantity of stations connected to it in all-call mode of operation |
| Signal-To-Noise Ratio: | 60 dB or greater at rated output |
| Frequency Response: | Plus or minus 2 dB from 200 Hz to 10,000 Hz |

2.3 TERMINALS

Terminals shall be solderless, tool-crimped pressure type.

2.4 COMMUNICATIONS WIRING

Type of signal and control circuit wire and number of conductors shall be provided as recommended by the intercommunication system manufacturer, and as necessary to provide a complete and operable system.

2.5 SURGE PROTECTION

Major components of the system such as Master Stations, Amplifiers, and Remote Stations, shall have a device, either internal or external, which shall provide protection against voltage spikes and current surges.

PART 3 EXECUTION

3.1 INSTALLATION

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as specified and shown. Units to be mounted outside or subject to inclement conditions shall be weatherproof or be mounted in weatherproof enclosures.

3.1.1 Signal and Control Circuits Wiring

Signal and control circuits shall be installed in accordance with NFPA 70 and as indicated.

3.1.2 Conduit and Tubing Systems

Wiring shall be installed in rigid conduit, intermediate metal conduits, or electric metallic tubing as specified in Section 16415ELECTRICAL WORK, INTERIOR.

3.2 GROUNDING

The connection of interfacing components shall be accomplished through the use of transformers and the tying of interconnecting lines to a unit ground bus at one end only. The ground and distribution ground buses shall be solid copper wire with insulating covering.

3.3 ACCEPTANCE TESTS

After installation has been completed, the Contractor shall conduct an acceptance test, using the approved test plan, to demonstrate that the equipment operates in accordance with specification requirements. The Contractor shall notify the Contracting Officer 5 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written approval of the test plans. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross-talk or noise from other links or nondesignated units.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16770

RADIO AND PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Multi-Channel System
 - 1.2.2 Multi-Channel System with Paging
 - 1.2.3 Single Channel System
 - 1.2.4 System Performance
- 1.3 SUBMITTALS
- 1.4 DELIVERY AND STORAGE
- 1.5 VERIFICATION OF DIMENSIONS

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
 - 2.1.1 Identical Items
 - 2.1.2 Nameplates
- 2.2 MIXER-PREAMPLIFIER
- 2.3 POWER AMPLIFIERS
- 2.4 MICROPHONE INPUT EXPANDER
- 2.5 MICROPHONES
 - 2.5.1 Microphone Jack
 - 2.5.2 Microphone Stand
- 2.6 LOUDSPEAKERS
 - 2.6.1 Horn Speaker
- 2.7 SPEAKER SWITCHING PANEL
- 2.8 CASSETTE TAPE EQUIPMENT
- 2.9 PRIORITY RELAYS AND CONTROLS
- 2.10 SWITCHES AND CONTROLS
 - 2.10.1 Radio System Control Switch
 - 2.10.2 Remote Loudspeaker ON/OFF Switches
 - 2.10.3 Remote Loudspeaker Volume Controls
- 2.11 EQUIPMENT RACKS
- 2.12 SPEAKER AND MICROPHONE CABLE
- 2.13 POWER SURGE PROTECTION
- 2.14 SIGNAL SURGE PROTECTION

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Equipment Racks
 - 3.1.2 Wiring
- 3.2 GROUNDING
- 3.3 ACCEPTANCE TESTS

-- End of Section Table of Contents --

SECTION 16770

RADIO AND PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA ANSI/EIA/310-D (1992) Cabinets, Racks, Panels, and
Associated Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

1.2 SYSTEM DESCRIPTION

The public address system shall consist of an audio distribution network to include amplifiers, mixers, microphones, speakers, cabling, and any ancillary components required to meet the required system configuration and operation.

1.2.1 Multi-Channel System

The system shall provide sixteen (16) channels of sound for distribution over an audio network to each lane and to loudspeakers as indicated. Each channel shall be separate, and equipment for each channel shall be identical, except for alternate program inputs which shall be suitable for the alternate source specified. The system shall include antennas, tuners, amplifiers, and all accessories required.

1.2.2 Multi-Channel System with Paging

The system shall include microphones, microphone outlet receptacles, microphone inputs with preamplifiers, inputs for compact disc, magnetic tape, telephone, and program sources, all channel paging, control for each input, power amplifying equipment, and accessories required to output the public address and paging audio signals through selected portions of the audio distribution network as indicated. The paging signal shall replace all channels of the radio system output, when the paging function is activated.

1.2.3 Single Channel System

The system shall control and amplify an audio program for distribution within the areas indicated. Components of the system shall include a mixer-preamplifier, mixer-amplifier, mike input expander, power amplifier, microphone, speaker system, phonograph, compact disc, tape equipment, AM-FM

tuner cabling, and other associated hardware.

1.2.4 System Performance

The system shall provide even sound distribution throughout the designated area, plus or minus 3 dB for the 1-octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Contracting Officer. The system shall be capable of delivering 75 dB average program level with additional 10 dB peaking margin sound pressure level (SPL) to any location in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Pascal (0.00002 Newtons per square meter).

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Spare Parts; FIO.

Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Public Address System; GA.

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-09 Reports

Test Plan; GA.

Test plan and test procedures for the acceptance tests. The test plan and test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedure shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

Acceptance Tests; GA.

Test reports in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance

criteria, upon completion and testing of the installed system. The reports shall include the manufacturer, model number, and serial number of test equipment used in each test. Each report shall indicate the final position of controls and operating mode of the system.

SD-19 Operation and Maintenance Manuals

Public Address System; GA.

Six copies of the operation manual outlining the step-by-step procedures required for system start up, operation, and shutdown. The manual shall include equipment layout and schematics of simplified wiring and control diagrams of the system as installed, the manufacturer's name, model number, and brief description of all equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The manual shall include equipment layout and schematics and simplified wiring and control diagrams of the system.

1.4 DELIVERY AND STORAGE

Equipment placed in storage until installation time shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

1.5 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment to be provided shall be the standard products of a manufacturer regularly engaged in the manufacture of such products, and shall essentially duplicate material and equipment that have been in satisfactory use at least 2 years. All components used in the system shall be commercial designs that comply with the requirements specified. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.1 Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, model and catalog number, and serial number on a plate secured to the equipment.

2.2 MIXER-PREAMPLIFIER

Mixer-preamplifier shall as a minimum conform to the following specifications:

Rated Output: 18 dB

Frequency Response: Plus or Minus 1 dB, 20 - 20,000 Hz

Distortion: Less than 0.2 percent, 20 - 20,000 Hz

Signal to noise: Microphone - 60 dB
Aux - 70 dB

Inputs: 5 independent balanced low-impedance,
transformer-isolated

Input Sensitivity: Microphone - 0.003 volts
Aux - 0.125 volts
Magnetic Cartridge - 0.0005 volts

Input Channel

Isolation: 80 dB minimum

Tone Controls: Plus or Minus 10 dB range at 50 and
15,000 Hz

Power Requirement: 110-125 Vac 60 Hz

2.3 POWER AMPLIFIERS

Power amplifiers as a minimum conform to the following specifications:

Rated power output: 250 watts, 300 watts and 600 watts as indicated
RMS

Frequency Response: Plus or Minus 2 dB, 60-13,000 Hz

Distortion: Less than 2 percent at RPO, 600-13,000 Hz

Input Impedance: 50 k ohm unbalanced

Output Impedance: 83.3, 10.4, 8.0, and 4.0 ohms

Output voltage: 70.7, 25, 22, and 15.5 volts

Power Requirement: 110-125 Vac 60 Hz

2.4 MICROPHONE INPUT EXPANDER

Microphone input expander shall as a minimum conform to the following specifications:

Rated Outputs: 0.25 volts into 10,000 ohms
1.0 volts into 10,000 ohms

Frequency Response: Plus or Minus 2 dB, 20 - 20,000 Hz

Distortion: Less than 0.5 percent 20 - 20,000 Hz

| | |
|--------------------------|--|
| Inputs: | 4 transformer - coupled balanced 150 ohm |
| Input Sensitivity: | 0.003 volts |
| Input Channel Isolation: | 70 dB minimum |
| Power Requirement: | 28 Vdc |

2.5 MICROPHONES

Microphones shall as a minimum conform to the following specifications:

| | |
|----------------------|--------------------------------|
| Application: | Desk with press-to-talk switch |
| Element: | Dynamic |
| Frequency Response: | 50 - 12,000 Hz |
| Impedance: | 150 ohms (nominal) |
| Front-to-back Ratio: | 20 dB |

2.5.1 Microphone Jack

Each outlet for microphones shall consist of a standard outlet box, flush-mounted, and fitted with a three-pole, polarized, locking-type, female microphone jack and a corrosion resistant-steel device plate.

2.5.2 Microphone Stand

Each microphone shall have an associated stand which as a minimum shall consist of 35 by 63 inch chrome tube assembly with grip-action for locking control. Desk applications shall be as a minimum constructed of chrome tubing with a charcoal finish.

2.6 LOUDSPEAKERS

2.6.1 Horn Speaker

The horn speaker shall as a minimum conform to the following specifications:

| | |
|---------------------|--|
| Application: | Outdoor/Weatherproof |
| Frequency Response: | 400 - 14,000 Hz |
| Power Taps: | 70 volt line - .9, 1.8, 3.8, 7.5, and 15 watts |
| Impedance: | 5000, 2500, 1300, 670, 330, 90, and 45 ohms |
| Power Rating: | Normal - 30 watts continuous |

2.7 SPEAKER SWITCHING PANEL

Zone control shall be provided for the paging function. The speaker

switching panel shall contain at least 16 double-pole, 3-position lever-type selector switches with mechanical detents and shall be rack-mounted. A designation strip shall be provided. Power supply shall be provided for priority relays and controls, rack-mounted and sized for a capacity equal to 200 percent of the as-built control system, and shall operate at 24 Vdc. Input and output shall be protected to permit Class 2 wiring in accordance with NFPA 70.

2.8 CASSETTE TAPE EQUIPMENT

The dual cassette tape play deck shall as a minimum conform to the following specifications:

| | |
|---------------------|------------------------------------|
| Frequency Response: | Plus or minus 3 dB, 40 - 14,000 Hz |
| Wow and Flutter: | Less than 0.09 percent WRMS |
| Signal-to-Noise: | 64 dB |
| Distortion: | 1.3 percent |
| Play Head: | Hard Parmalloy |
| Operation: | Automatic Reverse |
| Power Requirements: | 110-125 Vac, 60 Hz 48 Vdc |

2.9 PRIORITY RELAYS AND CONTROLS

Priority relays and controls required to accomplish operations specified shall be provided. Relays shall be completely enclosed with a plastic dust cover for maximum protection against foreign matter, and shall be plug-in type. Relays shall be provided with a diode wired across the relay coil for transient suppression and shall be installed utilizing factory-prewired, rack-mounted receptacle strips. Coil shall be maximum 24 volts dc.

2.10 SWITCHES AND CONTROLS

2.10.1 Radio System Control Switch

The loudspeaker in each room, or group of speakers in a room, shall be provided with a flush program channel selector rotating-switch knob. The switch shall be mounted at location and height above the floor as shown and in accordance with Section 16415 ELECTRICAL WORK, INTERIOR. A volume control shall be installed with a switch at each station and shall be of the auto transformer type and set so that the maximum volume is sufficient for the area while not disturbing adjacent areas. If music is turned down or off, the paging signal shall override controls except speakers designated for music only. Each device plate shall be satin-finished, corrosion-resisting steel permanently marked to indicate the channel selected.

2.10.2 Remote Loudspeaker ON/OFF Switches

Remote switches shall be toggle switch 2-pole, wall-mounted, single gang type with engraved switch plates finished to match the approved finish of electrical wall switches. Low-voltage priority override relays shall be

provided as part of the switches with all wiring to the racks to allow override of the ON/OFF switches for priority announcements.

2.10.3 Remote Loudspeaker Volume Controls

Remote volume controls shall be an auto transformer type with detented 3 dB steps and an OFF position. The controls shall be wall-mounted in single-gang outlet boxes and furnished with engraved switching plates finished to match approved finish of electrical wall switches. Insertion loss of the controls shall not exceed 0.6 dB and the power-handling capacities of the control shall be 35 watts. Low-voltage priority override relays shall be furnished as part of these controls with all wiring to the racks to allow override of the volume controls for priority announcements.

2.11 EQUIPMENT RACKS

Equipment shall be mounted on 19 inch racks in accordance with EIA ANSI/EIA/310-D and located as shown on drawings. Ventilated rear panels, solid side panels, and solid top panels shall be provided. Perforations or louvers may be provided in front panels to ensure adequate ventilation of equipment. The racks and panels shall be factory finished with a uniform baked enamel over rust inhibiting primer.

2.12 SPEAKER AND MICROPHONE CABLE

Cables shall be of the gauge required depending upon the cable run length. In no case shall any cable be used which is smaller than 20 AWG. Insulation on the conductors shall be polyvinyl chloride (PVC) or an equivalent synthetic thermoplastic not less than 0.009 inch. Cables shall be shielded with a 34-gauge tinned soft copper strand formed into a braid. Cables shall be jacketed with a PVC or Fluoropolymer compound. The jacket thickness shall be 0.0200 inch minimum.

2.13 POWER SURGE PROTECTION

Major components of the system such as power amplifiers, mixer-preamplifiers, phonographs, and tuners, shall have a device, whether internal or external, which provides protection against voltage spikes and current surges originating from commercial power sources.

2.14 SIGNAL SURGE PROTECTION

Major components of the system shall have internal protection circuits which protects the component from mismatched loads, direct current, and shorted output lines.

PART 3 EXECUTION

3.1 INSTALLATION

All equipment shall be installed as indicated and specified, and in accordance with the manufacturer's recommendations except where otherwise indicated. Equipment mounted out-of-doors or subject to inclement conditions shall be weatherproofed.

3.1.1 Equipment Racks

Racks shall be mounted side-by-side and bolted together. Items of the same function shall be grouped together, either vertically or side-by-side.

Controls shall be symmetrically arranged at a height as shown. Tape equipment shall be at a height above the floor as shown. Audio input and interconnections shall be made with approved shielded cable and plug connectors; output connections may be screw terminal type. All connections to power supplies shall utilize standard male plug and female receptacle connectors with the female receptacle being the source side of the connection. Inputs, outputs, interconnections, test points, and relays shall be accessible at the rear of the equipment rack for maintenance and testing. Each item shall be removable from the rack without disturbing other items or connections. Empty space in equipment racks shall be covered by blank panels so that the entire front of the rack is occupied by panels.

3.1.2 Wiring

Wiring shall be installed in rigid conduit, intermediate metal conduit, cable trays, or electric metallic tubing as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Wiring for microphone, grounding, line level, video, speaker and power cables shall be isolated from each other by physical isolation and metallical shielding. Shielding shall be terminated at only one end.

3.2 GROUNDING

All grounding practices shall comply with NFPA 70. The antenna mast shall be separately grounded. The system shall utilize a multiple-point signal grounding scheme where conductive path connections are required between each piece of equipment and the reference ground point. An isolated ground bar for power shall be provided for the connection of the main system components. The ground bar shall be connected to the main service ground utilizing a No. 6 conductor.

3.3 ACCEPTANCE TESTS

After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The Contractor shall notify the Contracting Officer 10 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or nondesignated units.

-- End of Section --

APPENDIX A

Site Location Plan

Boring Location Plan

Keys To Soil Classification

Test Boring Records

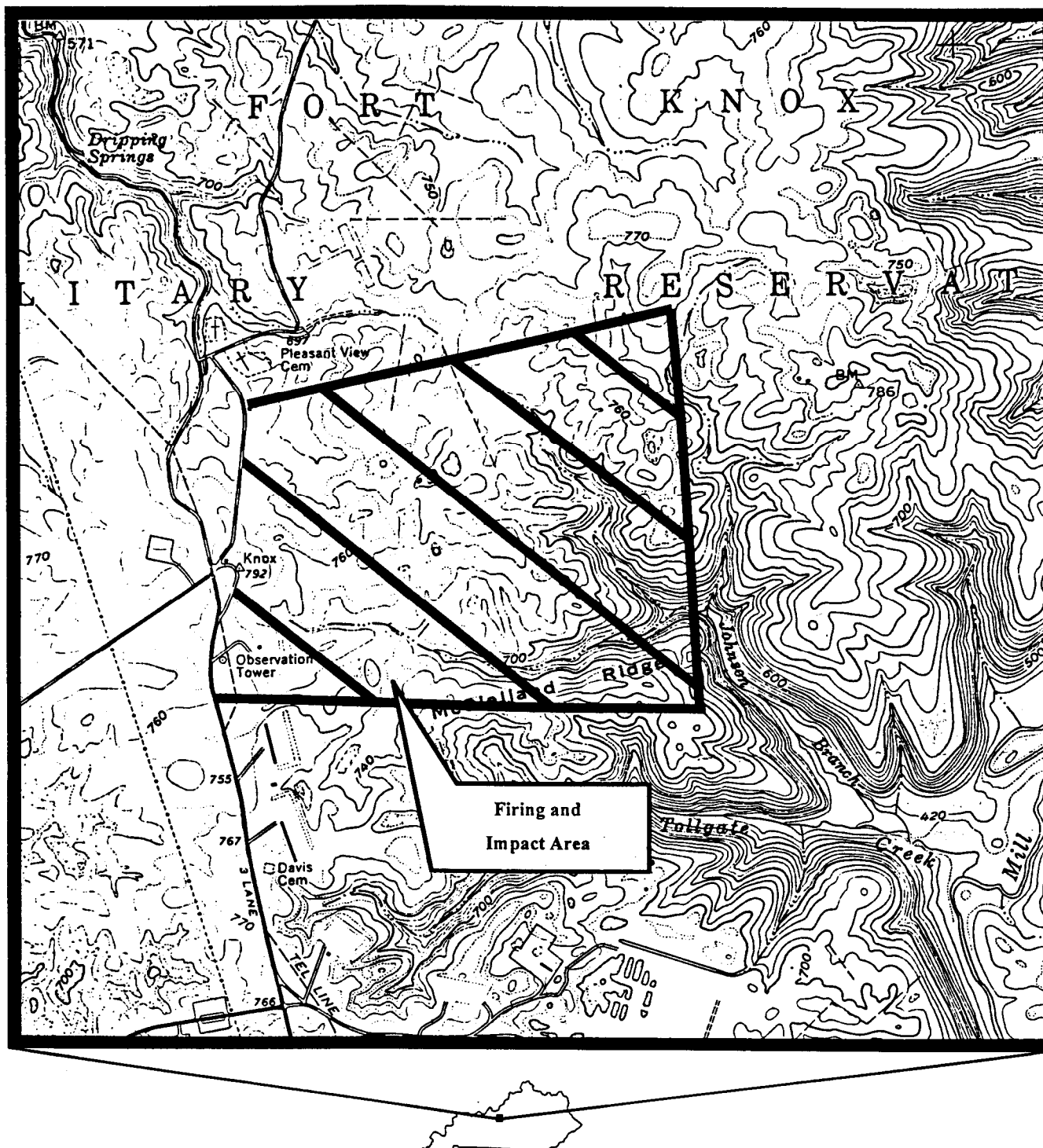
Test Pit Records

Laboratory Testing Procedures

Summary of Laboratory Test Data

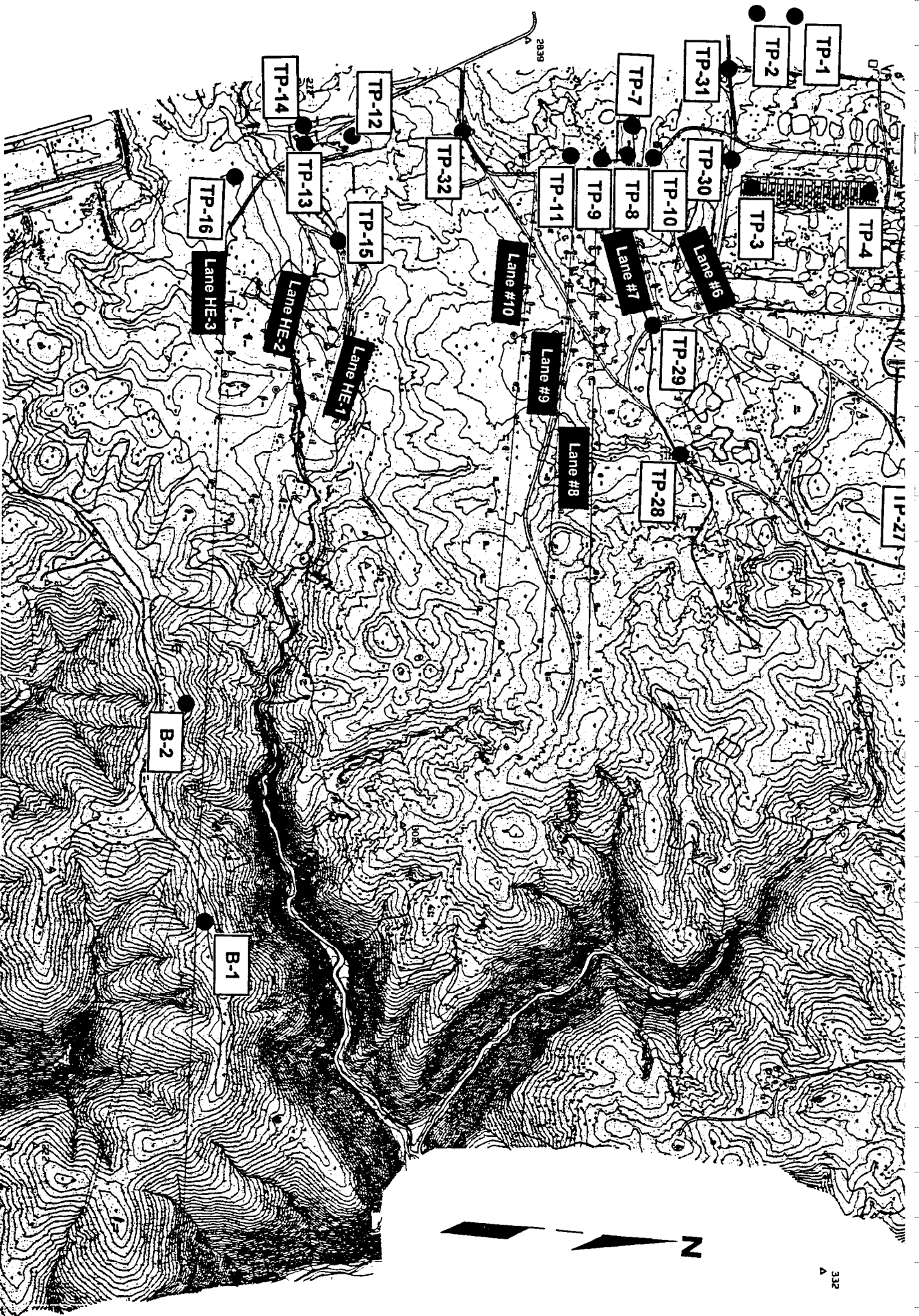
Atterberg Limits

Proctor Results



ENGINEERING AND ENVIRONMENTAL SERVICES

FIGURE 1



POLYENGINEERING, INC.

FORT KNOX
QTR UPGRADE



LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

BORING AND TEST PIT LOCATION PLAN

FORT KNOX, KENTUCKY
PROJECT NO.: 50545-8-2390





FIGURE 2





















CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

| NO. OF BLOWS, N | DEGREE OF COMPACTNESS | PARTICAL SIZE IDENTIFICATION |
|-----------------|-----------------------|------------------------------------|
| 0-4 | Very Loose | BOULDERS: Greater than 300 mm |
| 5-10 | Loose | COBBLES: 75 mm to 300 mm |
| SANDS 11-20 | Firm | GRAVEL: Coarse - 19.0 mm to 75 mm |
| & 21-30 | Very Firm | Fine - 4.75 mm to 19.0 mm |
| GRAVELS: 31-50 | Dense | SANDS: Coarse - 2.00 mm to 4.75 mm |
| OVER 50 | Very Dense | Medium - 0.425 mm to 2.00 mm |
| | | Fine - 0.075 mm to 0.425 mm |
| | CONSISTENCY | SILTS & CLAYS: Less than 0.075 mm |
| 0-2 | Very Soft | |
| 3-4 | Soft | |
| SILTS 5-8 | Firm | |
| & 9-15 | Stiff | |
| CLAYS: 16-30 | Very stiff | |
| 31-50 | Hard | |
| OVER 50 | Very Hard | |

KEY TO DRILLING SYMBOLS

| | | | | |
|---|--------------------|---|---------------------------------|--------------------------|
|  | Undisturbed Sample |  | Water Table 24 HR. | M = 82% Moisture Content |
|  | Split Spoon Sample |  | Water Table at Time of Drilling | N Standard Penetration |

KEY TO SOIL CLASSIFICATIONS

| | | | |
|--|---|---|---|
|  | GW - Well-graded gravels, gravel-sand mixtures, little or no fines |  | CL - Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, lean clays |
|  | GP - Poorly graded gravels or gravel-sand mixtures, little or no fines |  | OL - Organic silts and organic silty clays of low plasticity |
|  | GM - Silty gravel, gravel-sand-silts mixture |  | MH - Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
|  | GC - Clayey gravels, gravel-sand-clay mixtures |  | CH - Inorganic clays of high plasticity, fat clays |
|  | SW - Well-graded sands, gravelly sands, little or no fines |  | OH - Organic clays of medium to high plasticity, organic silts |
|  | SP - Poorly graded sands or gravelly sands, little or no fines |  | Topsoil |
|  | SM - Silty sands, sand-silt mixtures |  | CONCRETE |
|  | SC - Clayey sands, sand-clay mixtures |  | AF - Existing Soil Fill |
|  | ML - Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |  | ASPHALT |

KEY SHEET TO SOIL CLASSIFICATION FOR TEST PITS

Correlation of Dynamic Cone Penetration Resistance With Soil Consistency and Relative Density

| Silt and Clay | |
|--------------------------------------|------------------|
| Blow Count (bpi) | Soil Consistency |
| Less Than 2 | Very Soft |
| 2 to 3 | Soft |
| 4 to 6 | Firm |
| 7 to 12 | Stiff |
| 13 to 24 | Very Stiff |
| Greater Than 24 | Hard |
| bpi = blows per 1-3/4 inch increment | |

| Sand and Gravel | |
|--------------------------------------|-----------------------|
| Blow Count (bpi) | Degree of Compactness |
| Less Than 3 | Very Loose |
| 3 to 8 | Loose |
| 9 to 16 | Firm |
| 17 to 24 | Very Firm |
| 25 to 40 | Dense |
| Greater Than 40 | Very Dense |
| bpi = blows per 1-3/4 inch increment | |

Particle Size Identification

| Particle | Size Range | Particle | Size Range |
|------------------|------------------------|---------------|------------------|
| Boulders | Greater Than 12 inches | Sand: | |
| Cobbles | 3 to 12 inches | Coarse | 80 to 200 mils |
| Gravel: | | Medium | 20 to 80 mils |
| Coarse | 3/4 to 3 inches | Fine | 3 to 20 mils |
| Fine | 0.2 to 3/4 inches | Silt and Clay | Less Than 3 mils |
| mil = 0.001 inch | | | |

Test Pit Symbols & Abbreviations

∇ Water depth in test pit at the end of excavation

WOH the Weight Of Hammer forced the rod over 1-3/4 inches into the soil stratum

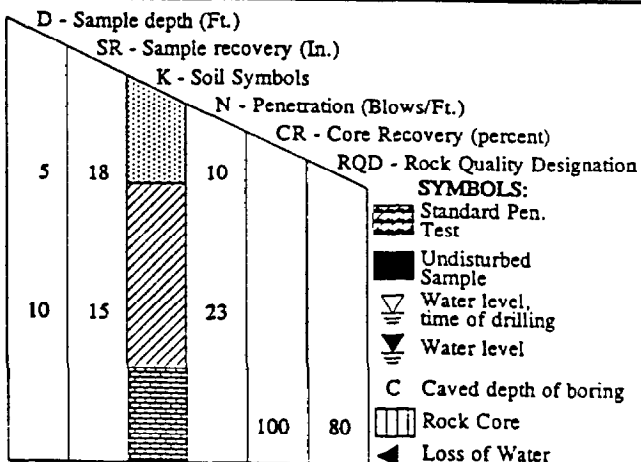
DCP Dynamic Cone Penetrometer measured blows per 1-3/4 inch-increment (bpi)

PP Pocket Penetrometer measured in tons per square foot (tsf)

Unified Soil Classification System

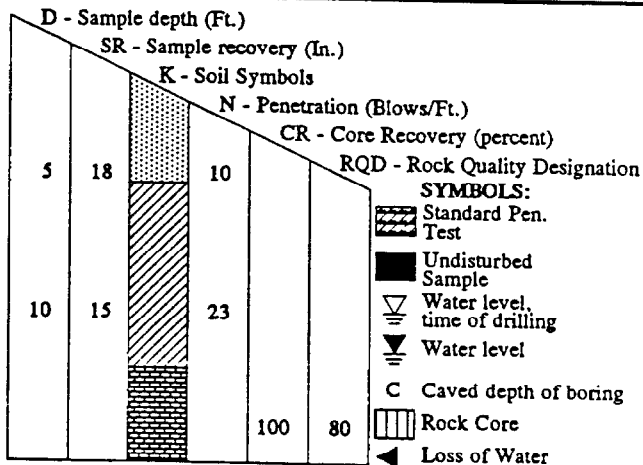
- ML Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity
- CL Inorganic clay of low to medium plasticity: gravelly clay, sandy clay, silty clay, lean clay
- OL Organic silt and organic silty clay of low plasticity
- MH Inorganic silt, micaceous or diatomaceous fine sandy or silty soil, elastic silt
- CH Inorganic clay of medium to high plasticity: fat clay
- OH Organic clay of medium to high plasticity, organic silt
- SM Silty sand, sand-silt mixtures
- SC Clayey sand, sand-clay mixtures
- SP Poorly (uniformly) graded sand or gravelly sand, little or no fines
- SW Well-graded sand, gravelly sand, little or no fines
- GM Silty gravel, gravel-sand-silt mixtures
- GC Clayey gravel, gravel-sand-clay mixtures
- GP Poorly (uniformly) graded gravel or gravel-sand mixtures, little or no fines
- GW Well-graded gravel, gravel-sand mixtures, little or no fines

| STRATUM ELEV. DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|------------------------|---|------|----|---|----|----|-----|--|
| 0.0 | | | | | | | | |
| 0.7 | TOPSOIL | | | | | | | |
| 1.5 | STIFF, brown, silty, LEAN CLAY (CL) | 1.0 | 6 | | 11 | | | Boring Location: Approx. 3350 feet down range on lane HE-1 |
| | VERY STIFF TO HARD, reddish brown to brown, FAT CLAY (CH) | 2.5 | 13 | | 19 | | | Driller: JEDI |
| | | | | | | | | Drilling Rig: B-56 |
| | | | | | | | | Hammer: Manual |
| | | | | | | | | Surface Cover: Grass |
| | | 5.0 | 14 | | 32 | | | Chert fragments in sample collected from 4 to 5.5 feet |
| | | 7.5 | 12 | | 33 | | | |
| | | 10.0 | 15 | | 31 | | | Chert fragment in sample collected from 9 to 10.5 feet |
| | | 14.5 | 5 | | 26 | | | |
| 20.0 | BORING TERMINATED AT 20.0 FEET | 19.5 | 14 | | 35 | | | C Dry at completion of drilling |



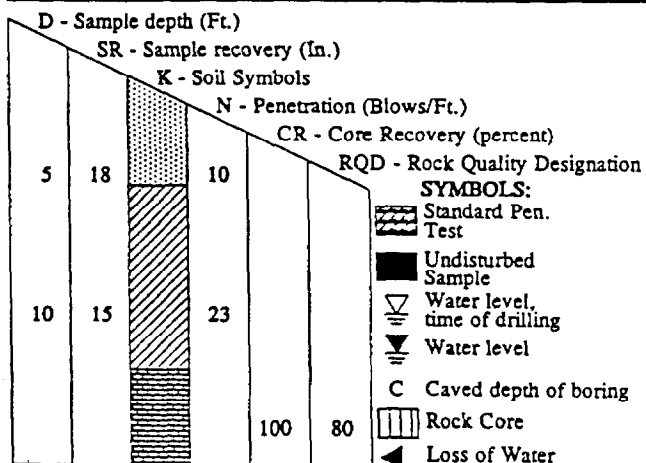
| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-1 |
| DATE DRILLED | May 29, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| STRATUM ELEV. DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|------------------------|--|-----|----|---|---|----|-----|--|
| 0.0 | AUGER TO 6 FEET WITHOUT SAMPLING | | | | | | | Boring Location: Approx. 3350 feet down range on lane HE-1 Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Grass |
| 6.0 | VERY STIFF TO HARD, reddish brown to brown, FAT CLAY (CH) | 7.0 | 24 | | | | | |
| 8.0 | BORING TERMINATED AT 8.0 FEET | | | | | | | C Dry at completion of drilling |



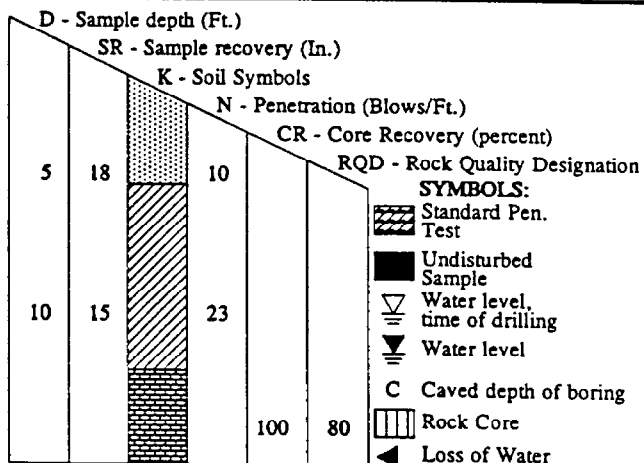
| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-1A |
| DATE DRILLED | May 29, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QRT UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| STRATUM ELEV. DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|------------------------|--|------|----|---|----|----|-----|---|
| 0.0 | | | | | | | | |
| | FIRM to VERY STIFF, light brown, silty, LEAN CLAY (CL) | 1.0 | 8 | | 8 | | | Boring Location: Approx. 2200 feet down range on lane HE-3 Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Brush |
| | | 2.5 | 7 | | 17 | | | |
| 3.5 | VERY STIFF TO HARD, reddish brown to mottled reddish brown and gray, FAT CLAY (CH) | 5.0 | 14 | | 29 | | | |
| | | 7.5 | 15 | | 32 | | | |
| | | 10.0 | 14 | | 28 | | | |
| | | | | | | | | Chert fragments in samples collected from 6.5 to 15 feet |
| 12.0 | VERY STIFF TO HARD, yellowish brown, FAT CLAY (CH) | 14.5 | 15 | | 40 | | | |
| | | 19.5 | 15 | | 24 | | | |
| | | | | | | | | C |
| 25.0 | BORING TERMINATED AT 25.0 FEET | 24.5 | 16 | | 19 | | | Dry at completion of drilling |



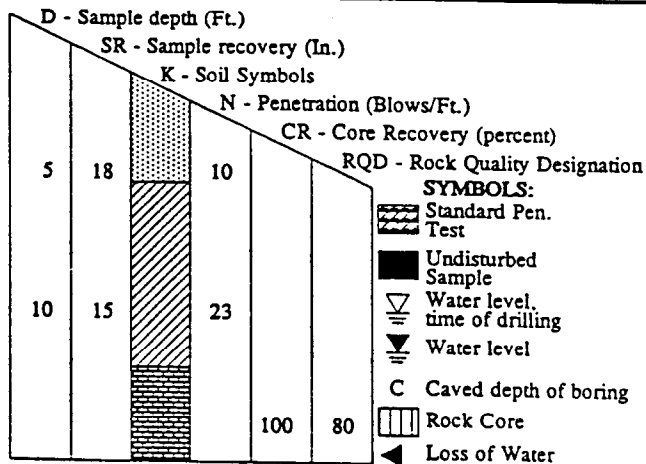
| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-2 |
| DATE DRILLED | May 29, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| STRATUM ELEV. DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|------------------------|--|------|----|---|----|----|-----|---|
| 0.0 | | | | | | | | |
| 1.5 | SOFT, light brown, SILT (ML) | 1.0 | 10 | | 3 | | | Boring Location: Approx. 750 feet down range on lane No. 2 Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Weeds |
| | STIFF, mottled light brown and gray SILT (ML) | 2.5 | 8 | | 15 | | | |
| 3.5 | | | | | | | | |
| | HARD, light brown to reddish brown, LEAN to FAT CLAY (CL-CH) | 5.0 | 9 | | 48 | | | |
| | | 7.5 | 8 | | 31 | | | |
| | | 10.0 | 10 | | 37 | | | |
| | | 14.5 | 12 | | 41 | | | |
| 20.0 | BORING TERMINATED AT 20.0 FEET | 19.5 | 14 | | 39 | | | C Dry at completion of drilling |



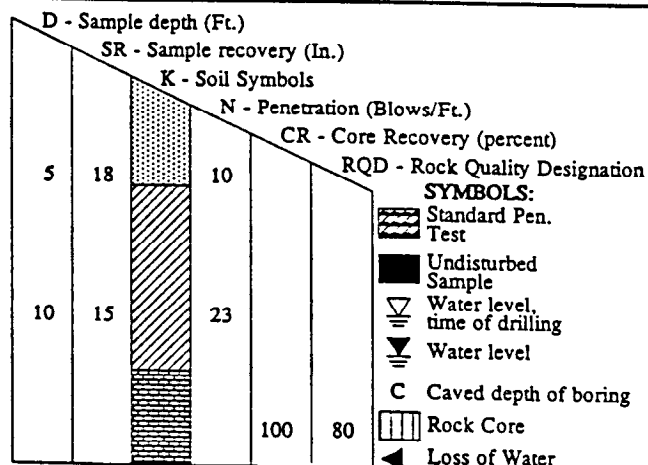
| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-3 |
| DATE DRILLED | June 1, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| ELEV. | STRATUM DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|-------|------------------|--|------|----|---|----|----|-----|--|
| 0.0 | 0.5 | TOPSOIL | | | | | | | |
| | | FIRM to STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 1.0 | 6 | | 5 | | | Boring Location: Approx. 3300 feet down range on lane No. 3 Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Grass |
| | | | 2.5 | 12 | | 10 | | | |
| | 3.5 | VERY HARD, ligh brown, silty, LEAN CLAY (CL) | | | | | | | |
| | | | 5.0 | 6 | | 75 | | | |
| | 6.0 | VERY STIFF to HARD, light brown to reddish brown, LEAN to FAT CLAY (CL-CH) | | | | | | | |
| | | | 7.5 | 16 | | 36 | | | |
| | | | 10.0 | 10 | | 26 | | | |
| | | | 14.5 | 10 | | 30 | | | |
| | | | | | | | | | C |
| | 20.0 | BORING TERMINATED AT 20.0 FEET | 19.5 | 12 | | 16 | | | Chert fragments in sample collected from 18.5 to 20 feet Dry at completion of drilling |



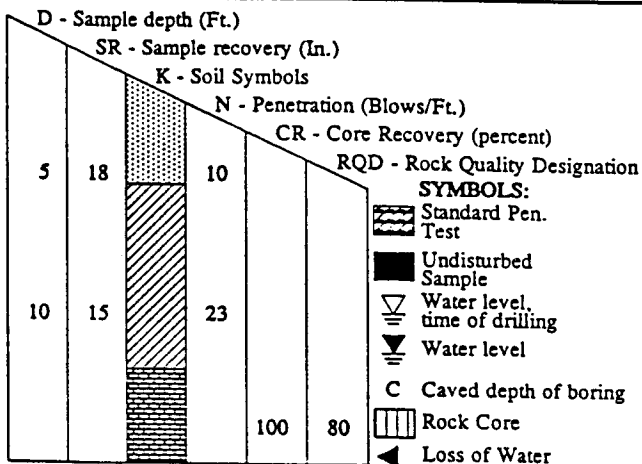
| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-4 |
| DATE DRILLED | June 1, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| ELEV. | STRATUM DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|-------|------------------|---|------|----|---|----|----|-----|--|
| | 0.0 | | | | | | | | |
| | 1.5 | FIRM, brown, silty, LEAN CLAY (CL) | 1.0 | 10 | | 7 | | | Boring Location: Approx. 1650 feet down range on lane No. 5 Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Weeds |
| | 2.5 | VERY STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 2.5 | 8 | | 16 | | | |
| | 3.5 | HARD, yellowish brown, silty, LEAN CLAY (CL) | 5.0 | 10 | | 43 | | | |
| | 6.0 | VERY STIFF to HARD, reddish brown, FAT CLAY (CH) | 7.5 | 12 | | 50 | | | |
| | | | 10.0 | 10 | | 31 | | | Chert fragments in sample collected from 6.5 to 8 feet |
| | | | 14.5 | 14 | | 29 | | | |
| | 20.0 | BORING TERMINATED AT 20.0 FEET | 19.5 | 10 | | 24 | | | C Dry at completion of drilling |



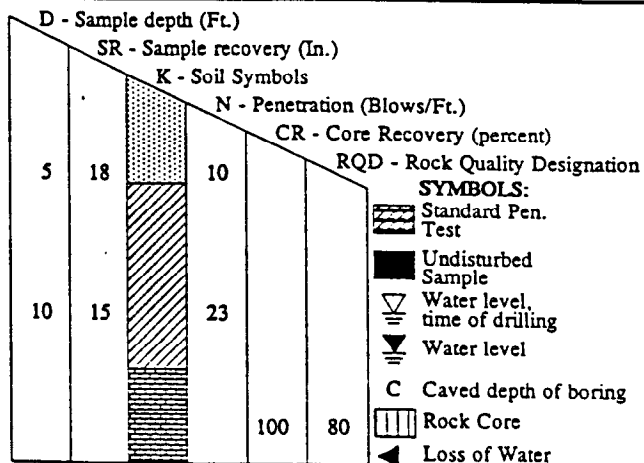
| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-5 |
| DATE DRILLED | June 1, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| STRATUM ELEV. DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|------------------------|---|------|----|---|----|----|-----|--|
| 0.0 | | | | | | | | |
| 1.5 | FIRM, light brown, silty, LEAN CLAY (CL) | 1.0 | 8 | | 8 | | | Boring Location: Approx. 30 feet south of north end of target carrier Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Weeds |
| | VERY STIFF to VERY HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | 2.5 | 10 | | 28 | | | |
| | | 5.0 | 8 | | 52 | | | |
| | | 7.5 | 10 | | 31 | | | |
| 8.5 | STIFF to VERY STIFF, mottled reddish brown and gray, FAT CLAY (CH) with chert fragments | 10.0 | 12 | | 23 | | | Two attempts to push UD tube from 10 to 12 feet were unsuccessful C |
| | | 14.5 | 12 | | 13 | | | |
| 15.0 | BORING TERMINATED AT 15.0 FEET | | | | | | | Dry at completion of drilling |



| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-6 |
| DATE DRILLED | June 1, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| STRATUM ELEV. DEPTH | VISUAL SOIL DESCRIPTION | D | SR | K | N | CR | RQD | REMARKS |
|------------------------|--|------|----|---|----|----|-----|--|
| 0.0 | | | | | | | | |
| | FIRM, light brown, silty, LEAN CLAY (CL) | 1.0 | 8 | | 7 | | | Boring Location: Approx. 30 feet north of south end of target carrier Driller: JEDI Drilling Rig: B-56 Hammer: Manual Surface Cover: Weeds |
| 3.5 | VERY STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 2.5 | 7 | | 7 | | | |
| 6.0 | VERY STIFF to HARD, reddish brown, FAT CLAY (CH) | 5.0 | 10 | | 29 | | | |
| | | 7.5 | 12 | | 33 | | | |
| | | 10.0 | 8 | | 37 | | | Rock fragments in sample collected from 9 to 10.5 feet |
| | | 12.0 | | | | | | |
| 15.0 | BORING TERMINATED AT 15.0 FEET | 14.5 | 8 | | 29 | | | C |
| | | | | | | | | Dry at completion of drilling |




| TEST BORING RECORD | |
|------------------------|-----------------------|
| BORING NUMBER | B-7 |
| DATE DRILLED | June 1, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | FORT KNOX QTR UPGRADE |
| PAGE 1 OF 1 | |
| LAW ENG./ENV. SERVICES | |

| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | TOPSOIL, heavily rooted | | | Location: Proposed latrine/shower on west side of Wilson Road- 60 feet from edge of road | |
| 1.5 | SOFT to FIRM, light brown, silty, LEAN CLAY (CL) | 0.5 | 3, 2, 4 | | |
| 2.5 | STIFF to VERY STIFF, light brown, silty, LEAN CLAY (CL) | | | | |
| | | 4.25 | 8, 10, 11 | Sample 1-1 taken at 4.0 feet | |
| | | 4.25 | 10, 11, 13 | Sample 1-2 taken at 5.0 feet | |
| 6.0 | VERY STIFF, mottled gray and light brown, LEAN CLAY (CL) | | | | |
| | | | | Sample 1-3 taken at 8.0 feet | |
| 8.5 | BACKHOE REFUSAL AT 8.5 FEET; TEST PIT TERMINATED | | | Test pit dry at completion | |
| 10.0 | | | | | |


REMARKS:

Previous grading in this area has occurred

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-1 |
| DATE | May 26, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |

| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | TOPSOIL | | | Location: Proposed headquarters building - 60 feet from edge of Wilson Road | |
| 0.05 | STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 0.5 | 5, 8, 10 | | |
| 2.0 | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | 4.0 | 12, 13, 15 | Sample 2-1 taken at 3.0 feet | |
| 5.8 | HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | >4.5 | 20, 31, >30 | | |
| 10.0 | BACKHOE REFUSAL AT 10.0 FEET; TEST PIT TERMINATED | | | Test pit dry at completion | |


REMARKS:

| TEST PIT RECORD | |
|---|-----------------------|
| TEST PIT | TP-2 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |

| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | TOPSOIL | | | Location: Proposed range support building in existing Heins Range | |
| 0.5 | HARD, brown, silty, LEAN CLAY (CL) | >4.5 | 30, 25, 28 | Sample 3-1 taken at 1.5 feet | |
| 2.5 | FIRM to STIFF, mottled gray and light brown, LEAN CLAY (CL) | 0.75 | 4, 7, 11 | Sample 3-2 taken at 3.0 feet | |
| | | 2.5 | 21, 17, 25 | Sample 3-3 taken at 5.0 feet | |
| 10.8 | TEST PIT TERMINATED AT 10.8 FEET | | | Test pit dry at completion | |


REMARKS:

No rock encountered to 10.8 feet, backhoe limit.

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-3 |
| DATE | May 26, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | STIFF, brown to light brown, silty, LEAN CLAY (CL) | .75 | 8, 8, 12 | Location: Proposed ammo breakdown building in existing Heins Range Sample 4-1 taken at 1.0 foot | |
| 3.0 | VERY STIFF, mottled gray and light brown, silty, LEAN CLAY (CL) | 3.5 | 14, 14, 15 | Sample 4-2 taken at 2.5 feet | |
| 3.8 | VERY STIFF, mottled reddish brown and light brown, FAT CLAY (CH) | 3.0 | 12, 13, 18 | Sample 4-3 taken at 4.8 feet | |
| 4.8 | TEST PIT TERMINATED AT 4.8 FEET | | | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS: Rock was not encountered

| TEST PIT RECORD | |
|---|-----------------------|
| TEST PIT | TP-4 |
| DATE | May 26, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | TOPSOIL | | | Location: Proposed classroom building in existing Heinz Range | |
| 0.8 | FIRM to STIFF, light brown, silty, LEAN CLAY (CL) | 1.0 | 4, 5, 7 | | |
| 2.0 | VERY STIFF, mottled gray and light brown, silty, LEAN CLAY (CL) | | | | |
| | | >4.5 | 19, 18, 22 | | |
| 5.5 | TEST PIT TERMINATED AT 5.5 FEET | >4.5 | 18, 24, 22 | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-5 |
| DATE | May 26, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | TOPSOIL | | | Location: Proposed bleachers in existing Heins Range | |
| 0.8 | FIRM, light brown, silty, LEAN CLAY (CL) | .75 | | | |
| 2.5 | STIFF to VERY STIFF, mottled gray and light brown, LEAN CLAY (CL) | 3.5 | | | |
| | | >4.5 | | | |
| 6.5 | VERY STIFF, mottled reddish brown and light brown, LEAN CLAY (CL) | | | Sample 6-1 taken at 8.5 feet | |
| 9.0 | BACKHOE REFUSAL AT 9.0 FEET; TEST PIT TERMINATED | | | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|---|-----------------------|
| TEST PIT | TP-6 |
| DATE | May 26, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | TOPSOIL | | | Location: Proposed latrine in existing Lawley Range | |
| 0.4 | FIRM, mottled gray and light brown, silty, LEAN CLAY (CL) | 0.5 | 2, 3, 4 | | |
| 2.5 | STIFF, mottled gray and light brown, silty, LEAN CLAY (CL) | 1.5 | 9, 11, 12 | | |
| 4.5 | VERY STIFF to HARD, mottled gray and light brown, silty, LEAN CLAY (CL) | >4.5 | 30, 20, 30 | Sample 7-1 taken at 4.5 feet | |
| | | | | Slow water seepage at 3 feet but not a continuous source | |
| 9.8 | | | | Test pit dry at completion | |
| 10.0 | BACKHOE REFUSAL AT 9.8 FEET; TEST PIT TERMINATED | | | | |

REMARKS:

| TEST PIT RECORD | |
|---|-----------------------|
| TEST PIT | TP-7 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|--|----------------|
| 0.0 | TOPSOIL | 0.5 | 3, 4, 6 | Location: Proposed classroom in existing Lawley Range | |
| 0.4 | FIRM, light brown silty, LEAN CLAY (CL) | | | | |
| 2.5 | VERY STIFF to HARD, mottled gray and light brown, silty, LEAN CLAY (CL) | 2.0 | 19, 24, >30 | | |
| | | 2.25 | 20, 18, 22 | | |
| 9.0 | TEST PIT TERMINATED AT 9.0 FEET | | | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-8 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | TOPSOIL | | | Location: Proposed bleachers in existing Lawley Range | |
| 0.4 | STIFF, light brown, silty, LEAN CLAY (CL) | 1.5 | 5, 10, 13 | | |
| 2.5 | VERY STIFF, mottled gray and light brown, silty, LEAN CLAY (CL) | 4.5 | 14, 13, 14 | | |
| 6.0 | TEST PIT TERMINATED AT 6.0 FEET | 3.5 | 11, 13, 20 | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-9 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | | | | | |
| 0.2 | TOPSOIL | | | Location: Proposed tower in existing Lawley Range | |
| | FIRM to STIFF, mottled gray and light brown, LEAN CLAY (CL) | 0.75 | 3, 5, 7 | | |
| | | | | | |
| 3.0 | | >4.5 | 20, 20, >30 | | |
| | VERY STIFF to HARD, mottled gray and light brown, LEAN CLAY (CL) | | | | |
| | | | | | |
| 5.5 | | >4.5 | >30 | | |
| 5.8 | HARD, red, FAT CLAY (CH) | | | Test pit dry at completion | |
| | TEST PIT TERMINATED AT 5.8 FEET | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-10 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | | | | | |
| 0.3 | TOPSOIL | | | Location: Proposed ammo breakdown building in existing Lawely Range | |
| | FIRM, light brown, silty, LEAN CLAY (CL) | 2.25 | 4, 4, 5 | | |
| 2.0 | | | | | |
| | VERY STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 2.75 | 10, 14, 14 | | |
| 4.6 | | | | | |
| | TEST PIT TERMINATED AT 4.6 FEET | >4.5 | 18, 19, 21 | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-11 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | GRAVEL FILL with many fines | | | Location: Proposed ammo breakdown building near proposed HE lanes | |
| 1.3 | FIRM to STIFF, mottled, light brown and gray, silty, LEAN CLAY (CL) | | | | |
| | | 1.75 | 6, 6, 10 | | |
| 5.0 | TEST PIT TERMINATED AT 5.0 FEET | 4.5 | 10, 17, 17 | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-12 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | GRAVEL FILL with many fines | | | Location: Proposed bleachers near proposed HE lanes | |
| 1.5 | FIRM to STIFF, light brown, silty, LEAN CLAY (CL) | | | | |
| 4.0 | VERY STIFF to HARD, light brown, silty, LEAN CLAY (CL) | 0.75 | 4, 6, 8 | | |
| 5.5 | TEST PIT TERMINATED AT 5.5 FEET | 2.5 | 10, 16, 30 | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-13 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | GRAVEL FILL with many fines | | | Location: Proposed latrine near poposed HE lanes | |
| 1.0 | STIFF, light brown, silty, LEAN CLAY (CL) | 2 | 10, 12, 12 | | |
| | | | | | |
| | | | | | |
| | | 1.25 | 6, 8, 9 | | |
| 4.0 | HARD, light brown, silty, LEAN CLAY (CL) | | | | |
| 5.0 | TEST PIT TERMINATED AT 5.0 FEET | >4.5 | 25, >30 | Test pit dry at completion | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-14 |
| DATE | May 28, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|--------------------------------------|----------------|
| 0.0 | GRAVEL (of #357 size) with many fines | | | Location: Entrance Road to lane HE-1 | |
| 2.3 | HARD, light brown, silty, LEAN CLAY (CL) | | | | |
| 5.0 | TEST PIT TERMINATED AT 5.0 FEET | >4.5 | 24, 25, 30 | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-15 |
| DATE | May 29, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|--------------------------------------|----------------|
| 0.0 | | | | | |
| 0.3 | TOPSOIL | | | Location: Entrance road to lane HE-3 | |
| | STIFF, light brown, silty, LEAN CLAY (CL) | 1.5 | 4, 6, 8 | | |
| 2.0 | | | | | |
| | STIFF to VERY STIFF, light brown, silty, LEAN CLAY (CL) | 2.75 | 14, 14, 15 | | |
| 5.0 | | 3.0 | 10, 12, 14 | Test pit dry at completion | |
| | TEST PIT TERMINATED AT 5.0 FEET | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-16 |
| DATE | May 29, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | STIFF to VERY STIFF, light brown, sitly, LEAN CLAY (CL) | | | Location: Existing roadway behind farthest downrange fill and lane no. 5 | |
| 2.5 | VERY STIFF, light brown, silty, FAT CLAY (CH) | >4.5 | 14, 16, 15 | Sample 17-1 taken at 3.0 feet | |
| 5.0 | VERY STIFF, reddish brown, LEAN CLAY (CL) | | | | |
| 5.8 | TEST PIT TERMINATED AT 5.8 FEET | >4.5 | 18, 22, 20 | Sample 17-2 taken at 5.75 feet Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-17 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|--|----------------|
| 0.0 | STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 2.5 | | Location: Existing roadway between farthest downrange fills and lane no. 2 and no. 3 | |
| 2.0 | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | >4.5 | | | |
| 5.0 | TEST PIT TERMINATED AT 5.0 FEET | >4.5 | >30 | Sample 18-1 taken at 4.5 feet Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-18 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | | | Location: Existing roadway behind farthest downrange fill on lane no. 1 | |
| | | 3.5 | 20, 22, 20 | | |
| | | | | | |
| | | | | | |
| | | >4.5 | >30 | | |
| | | | | | |
| | | | | | |
| 5.0 | TEST PIT TERMINATED AT 5.0 FEET | >4.5 | >30 | Test pit dry at completion | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-19 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | | | Location: Existing roadway in front of farthest downrange cut on lane no. 1 | |
| | | 3.0 | | | |
| | | | | | |
| | | | | | |
| | | >4.5 | | | |
| | | | | | |
| | | | | | |
| 5.0 | TEST PIT TERMINATE AT 5.0 FEET | >4.5 | | Sample 20-1 taken at 5.0 feet Test pit dry at completion | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-20 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | STIFF, light brown, silty, LEAN CLAY (CL) | 2.25 | | Location: Existing roadway in farthest downrange cut on lane no. 3 | |
| | | | | | |
| | | | | | |
| | | 1.75 | | | |
| 4.0 | HARD, reddish brown, FAT CLAY (CH) | | | | |
| | | | | | |
| 5.0 | TEST PIT TERMINATED AT 5.0 FEET | >4.5 | | Sample 21-1 taken at 5.0 feet Test pit dry at completion | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-21 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | VERY STIFF to HARD, light brown, silty, LEAN CLAY (CL) | >4.5 | 12, >30 | Location: Existing roadway between cuts on lane no. 4 (heavily eroded, grass covered, and presently not used) | |
| 4.8 | | >4.5 | >30 | Sample 22-1 taken at 4.0 feet | |
| 5.3 | VERY STIFF, mottled brown and reddish brown, LEAN CLAY (CL) | >4.5 | 12, 14, 17 | Test pit dry at completion | |
| | TEST PIT TERMINATED AT 5.3 FEET | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-22 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | HARD, mottled, light brown and gray, silty, LEAN CLAY (CL) | >4.5 | | Location: Existing roadway in furthest downrange cut on lane no. 2 | |
| 4.5 | | >4.5 | | | |
| 5.0 | VERY STIFF, mottled, light brown and reddish brown, LEAN to FAT CLAY (CL-CH) | 3.5 | | Sample 23-1 taken at 5.0 feet Test pit dry at completion | |
| | TEST PIT TERMINATED AT 5.0 FEET | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-23 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | TOPSOIL | | | Location: Existing roadway in cut on lane no. 1 (grass covered and presently not used) | |
| 0.5 | STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 2.75 | | | |
| 2.0 | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | >4.5 | | Sample 24-1 taken at 5.0 feet Test pit dry at completion | |
| 5.3 | TEST PIT TERMINATED AT 5.3 FEET | >4.5 | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-24 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | VERY STIFF, mottled, light brown and gray, silty, LEAN CLAY (CL) | | 17, 17, 22 | Location: Existing roadway between lanes no. 3 and no. 4 | |
| 3.5 | HARD, mottled light brown and reddish brown, LEAN CLAY (CL) | | 15, 20, >30 | | |
| 4.8 | BACKHOE REFUSAL AT 4.9 FEET; TEST PIT TERMINATED | | | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-25 |
| DATE | June 3, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|--|----------------|
| 0.0 | TOPSOIL | | | Location: Approximately 1500 feet downrange on lane no. 1 (wooded area) | |
| 0.5 | FIRM to STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | | | | |
| | | 1.5 | | | |
| 3.0 | | | | Sample 26-1 taken at 3.0 feet | |
| | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | >4.5 | | | |
| | | | | | |
| | | | | | |
| 5.8 | | >4.5 | | Test pit dry at completion | |
| | TEST PIT TERMINATED AT 5.8 FEET | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-26 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | FINE and COARSE GRAVEL with many fines (approximatly # 357 size stone) | >4.5 | | Location: Existing roadway south of lane no. 5 | |
| 1.5 | VERY STIFF, grayish brown, silty, LEAN CLAY (CL) | | | Sample 27-1 taken at 1.0 feet | |
| 3.0 | VERY STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 4.5 | | Sample 27-2 taken at 2.3 feet | |
| 4.5 | TEST PIT TERMINATED AT 4.5 FEET | | | Sample 27-3 taken at 4.5 feet Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-27 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|--|-------------|--------------|---|----------------|
| 0.0 | | | | | |
| 0.5 | FINE and COARSE GRAVEL with many fines (approximatly # 357 size stone) | | | Location: Existing roadway near fill on lane no. 7 | |
| | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | | | Sample 28-1 taken at 0.5 feet | |
| | | | | Sample 28-2 taken at 2.0 feet | |
| | | >4.5 | | | |
| | | | | Test pit dry at completion | |
| 6.0 | TEST PIT TERMINATED AT 6.0 FEET | >4.5 | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-28 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | | | | | |
| 0.8 | FINE and COARSE GRAVEL with many fines (approximatly # 357 size stone) | | | Location: Existing roadway on lane no. 7 | |
| | STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 3.5 | | Sample 29-1 taken at 0.5 feet | |
| 2.0 | | | | Sample 29-2 taken at 2.0 feet | |
| | VERY STIFF to HARD, mottled light brown ang gray, silty, LEAN CLAY (CL) | >4.5 | | | |
| | | 4.5 | | | |
| 5.0 | | | | Test pit dry at completion | |
| | TET PIT TERMINATED AT 5.0 FEET | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-29 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | | | | | |
| | FINE and COARSE GRAVEL with many fines (approximatly # 357 size stone) | | | Location: Existing roadway approximatly 700 feet from Wilson Road on Heins Range Sample 30-1 taken at 0.5 feet | |
| 1.5 | | | | | |
| | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | >4.5 | | Sample 30-2 taken at 2.5 feet | |
| | | 4.0 | | | |
| | | 4.5 | | | |
| 6.0 | | | | Test pit dry at completion | |
| | TEST PIT TERMINATED AT 6.0 FEET | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-30 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |


| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|--|----------------|
| 0.0 | FINE and COARSE GRAVEL with many fines (approximatly # 357 size stone) | | | Location: Existing roadway approximatly 100 feet from Wilosn Road in Heins Range | |
| | FIRM to SITFF, mottled light brown and gray, silty, LEAN CLAY (CL) | 1.5 | | | |
| 2.5 | VERY STIFF to HARD, mottled light brown and gray, silty, LEAN CLAY (CL) | 4.0 | | | |
| | | >4.5 | | | |
| 5.5 | TEST PIT TERMINATED AT 5.5 FEET | | | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-31 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |

| DEPTH (ft.) | DESCRIPTION | PP (tsf) | DCP (bpi) | NOTES | WATER LEVEL |
|----------------|---|-------------|--------------|---|----------------|
| 0.0 | FINE and COARSE GRAVEL with many fines (approximatly # 357 size stone) | | | Location: Existing roadway between lanes no. 10 and HE-1 | |
| 2.0 | STIFF, mottled light brown and gray, silty, LEAN CLAY (CL) | >4.5 | | | |
| 5.3 | TEST PIT TERMINATED AT 5.3 FEET | 3.0 | | Test pit dry at completion | |
| 10.0 | | | | | |

REMARKS:

| TEST PIT RECORD | |
|--|-----------------------|
| TEST PIT | TP-32 |
| DATE | June 10, 1998 |
| PROJECT NUMBER | 50545-8-2390 |
| PROJECT | Fort Knox QTR Upgrade |
| PAGE 1 OF 1 | |
|  LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. | |

KEY SHEET TO SOIL CLASSIFICATION FOR TEST PITS

Correlation of Dynamic Cone Penetration Resistance With Soil Consistency and Relative Density

| Silt and Clay | |
|--------------------------------------|------------------|
| Blow Count (bpi) | Soil Consistency |
| Less Than 2 | Very Soft |
| 2 to 3 | Soft |
| 4 to 6 | Firm |
| 7 to 12 | Stiff |
| 13 to 24 | Very Stiff |
| Greater Than 24 | Hard |
| bpi = blows per 1-3/4 inch increment | |

| Sand and Gravel | |
|--------------------------------------|-----------------------|
| Blow Count (bpi) | Degree of Compactness |
| Less Than 3 | Very Loose |
| 3 to 8 | Loose |
| 9 to 16 | Firm |
| 17 to 24 | Very Firm |
| 25 to 40 | Dense |
| Greater Than 40 | Very Dense |
| bpi = blows per 1-3/4 inch increment | |

Particle Size Identification

| Particle | Size Range | Particle | Size Range |
|----------|------------------------|---------------|-----------------|
| Boulders | Greater Than 12 inches | Sand: | |
| Cobbles | 3 to 12 inches | Coarse | 2 to 4.75 mm |
| Gravel: | | Medium | .42 to 2 mm |
| Coarse | 3/4 to 3 inches | Fine | 0.075 to .42 mm |
| Fine | 0.19 to 3/4 inches | Silt and Clay | < 0.075 mm |

Test Pit Symbols

∇ Water depth in test pit at the end of excavation
 WOH the Weight Of Hammer forced the rod over 1-3/4 inches into the soil stratum
 DCP Dynamic Cone Penetrometer measured blows per 1-3/4 inch-increment (bpi)
 PP Pocket Penetrometer measured in tons per square foot (tsf)

Unified Soil Classification System

- ML Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity
- CL Inorganic clay of low to medium plasticity: gravelly clay, sandy clay, silty clay, lean clay
- OL Organic silt and organic silty clay of low plasticity
- MH Inorganic silt, micaceous or diatomaceous fine sandy or silty soil, elastic silt
- CH Inorganic clay of medium to high plasticity: fat clay
- OH Organic clay of medium to high plasticity, organic silt
- SM Silty sand, sand-silt mixtures
- SC Clayey sand, sand-clay mixtures
- SP Poorly (uniformly) graded sand or gravelly sand, little or no fines
- SW Well-graded sand, gravelly sand, little or no fines
- GM Silty gravel, gravel-sand-silt mixtures
- GC Clayey gravel, gravel-sand-clay mixtures
- GP Poorly (uniformly) graded gravel or gravel-sand mixtures, little or no fines
- GW Well-graded gravel, gravel-sand mixtures, little or no fines

LABORATORY TESTING PROCEDURES

Soil Classification: Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current situations. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Test Boring Records."

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D 2487). Each of these classification systems and the in-place physical soil properties provide an index for estimating the soil's behavior. The soil classification and physical properties determined are presented in this report.

Atterberg Limits: Portions of the samples are taken for Atterberg Limits testing to determine the plasticity characteristics of the soil. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The plastic limit is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into tiny threads. The liquid limit and plastic limit are determined in accordance with ASTM D 4318.

Moisture Content: The Moisture Content is determined according to ASTM D 2216.

Unconfined Compression Tests: The unconfined compression test is an unconsolidated-undrained triaxial shear test with no lateral confining pressure. This test is used to determine the shear strength of clayey soils.

An unconfined compression test is performed according to ASTM D 2166 on a single section of an undisturbed sample extruded from a sampling tube. The sample is trimmed to a length-to-diameter ratio of about 2 and placed in the testing device. Incrementally increasing vertical loads are applied until the sample fails. Test results are provided in the form of a stress-strain curve or a value representing the unconfined compressive strength of the sample.

Compaction Tests: Compaction tests are run on representative soil samples to determine the dry density obtained by a uniform compactive effort at varying moisture contents. The results of the test are used to determine the moisture content and unit weight desired in the field for similar soils. Proper field compaction is necessary to decrease future settlements, increase the shear strength of the soil and decrease the permeability of the soil.

The two most commonly used compaction tests are the standard Proctor test and the modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the standard Proctor compaction test is run on samples from building or parking areas where small compaction equipment is anticipated. The modified Proctor compaction test is generally performed for heavy structures, highways, and other areas where large compaction equipment is expected. In both tests a representative soil sample is placed in a mold and compacted with a compaction hammer. Both tests have three alternate methods.

The moisture content and unit weight of each compacted sample is determined. Usually 4 to 5 such tests are run at different moisture contents. Test results are presented in the form of a dry unit weight versus moisture content curve. The compaction method used and any deviations from the recommended procedures are noted in this report.

Laboratory California Bearing Ratio Tests: The California Bearing Ratio, generally abbreviated to CBR, is a punching shear test and is a comparative measure of the shearing resistance of a soil. It provides data that is a semi-empirical index of the strength and deflection characteristics of a soil. The CBR is used with empirical curves to design pavement structures.

LABORATORY TESTING PROCEDURES (continued)

A laboratory CBR test is performed according to ASTM D 1883. The results of the compaction tests are utilized in compacting the test sample to the desired density and moisture content for the laboratory California Bearing Ratio test. A representative sample is compacted to a specified density at a specified moisture content. The test is performed on a 6-inch diameter, 4.58-inch-thick disc of compacted soil that is confined in a cylindrical steel mold. The sample is compacted in accordance with Method B or D of ASTM D 698 or D-1557.

CBR tests may be run on the compacted samples in either soaked or unsoaked conditions. During testing, a piston approximately 2 inches in diameter is forced into the soil sample at the rate of 0.05 inch per minute to a depth of 0.5 inch to determine the resistance to penetration. The CBR is the percentage of the load it takes to penetrate the soil to a 0.1 inch depth compared to the load it takes to penetrate a standard crushed stone to the same depth. Test results are typically shown graphically.

SUMMARY OF LABORATORY TEST DATA

| BORING NO. | SAMPLE DEPTH, FT. | SAMPLE TYPE** | USCS CLASSIFICATION | MAX. DRY DENSITY PCF (Modified) | UNIT WEIGHT PCF | | UNCONFINED COMPRESSIVE STRENGTH PSF | % FINER NO. 200 | SPECIFIC GRAVITY | NATURAL MOISTURE CONTENT, PERCENT | ATTERBERG LIMITS | | | OPTIMUM MOISTURE (Modified) |
|------------|-------------------|---------------|---------------------|---------------------------------|-----------------|------|-------------------------------------|-----------------|------------------|-----------------------------------|------------------|------|------|-----------------------------|
| | | | | | WET | DRY | | | | | L.L. | P.L. | P.I. | |
| B-1 | 0.0 - 1.5 | SS | | | | | | | | 26.0 | | | | |
| B-1 | 1.5 - 3.0 | SS | "CH" | | | | | | | 19.6 | 60 | 27 | 33 | |
| B-1 | 4.0 - 5.5 | SS | "CH" | | | | | | | 26.3 | 74 | 26 | 48 | |
| B-1 | 6.5 - 8.0 | SS | | 114.5 | 120.1 | 98.7 | | | | 28.9 | | | | 15.5 |
| B-1 | 9.0 - 10.5 | SS | | | | | | | | 29.2 | | | | |
| B-1 | 13.5 - 15.0 | SS | | | | | | | | 24.1 | | | | |
| B-1 | 18.5 - 20.0 | SS | | | | | | | | 24.6 | | | | |
| B-2 | 0.0 - 1.5 | SS | | | | | | | | 23.8 | | | | |
| B-2 | 1.5 - 3.0 | SS | "CL" | | | | | | | 27.0 | 34 | 22 | 12 | |
| B-2 | 4.0 - 5.5 | SS | "CH" | | | | | | | 22.2 | 60 | 23 | 37 | |
| B-2 | 6.5 - 8.0 | SS | | | | | | | | 19.6 | | | | |
| B-2 | 9.0 - 10.5 | SS | | | | | | | | 24.4 | | | | |
| B-2 | 13.5 - 15.0 | SS | | | | | | | | 25.2 | | | | |
| B-3 | 0.0 - 1.5 | SS | | | | | | | | 27.2 | | | | |
| B-3 | 1.5 - 3.0 | SS | "ML" | | | | | | | 19.7 | 31 | 30 | 1 | |
| B-3 | 4.0 - 5.5 | SS | | | | | | | | 16.5 | | | | |
| B-3 | 6.5 - 8.0 | SS | | | | | | | | 26.4 | | | | |

* Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary

** SS = Split-Spoon Sample (ASTM D 1586); UD = Undisturbed Sample (ASTM D 1587); BG = Bulk Bag Sample

Table Checked By:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
Louisville, Kentucky

Project Name: FORT KNOX - QTR UPGRADE
Project Number: 50545-8-2390

SUMMARY OF LABORATORY TEST DATA

| BORING NO. | SAMPLE DEPTH, FT. | SAMPLE TYPE** | USCS CLASSIFICATION | MAX. DRY DENSITY PCF (Modified) | UNIT WEIGHT PCF | | UNCONFINED COMPRESSIVE STRENGTH PSF | % FINER NO. 200 | SPECIFIC GRAVITY | NATURAL MOISTURE CONTENT, PERCENT | ATTERBERG LIMITS | | | OPTIMUM MOISTURE (Modified) |
|------------|-------------------|---------------|---------------------|------------------------------------|-----------------|-----|-------------------------------------|-----------------|------------------|-----------------------------------|------------------|------|------|--------------------------------|
| | | | | | WET | DRY | | | | | L.L. | P.L. | P.I. | |
| B-3 | 9.0 - 10.5 | SS | | | | | | | | 22.5 | | | | |
| B-3 | 13.5 - 15.0 | SS | | | | | | | | 28.0 | | | | |
| B-4 | 0.0 - 1.5 | SS | | | | | | | | 45.5 | | | | |
| B-4 | 1.5 - 3.0 | SS | | | | | | | | 16.2 | | | | |
| B-4 | 4.0 - 5.5 | SS | | | | | | | | 28.2 | | | | |
| B-4 | 6.5 - 8.0 | SS | | | | | | | | 18.4 | | | | |
| B-4 | 9.0 - 10.5 | SS | | | | | | | | 23.4 | | | | |
| B-4 | 13.5 - 15.0 | SS | | | | | | | | 32.3 | | | | |
| B-5 | 1.5 - 3.0 | SS | "CL" | | | | | | | 25.0 | 39 | 23 | 16 | |
| B-6 | 0.0 - 1.5 | SS | | | | | | | | 25.9 | | | | |
| B-6 | 1.5 - 3.0 | SS | | | | | | | | 27.8 | | | | |
| B-6 | 4.0 - 5.5 | SS | | | | | | | | 17.2 | | | | |
| B-6 | 6.5 - 8.0 | SS | | | | | | | | 20.1 | | | | |
| B-7 | 9.0 - 10.5 | SS | "CH" | | | | | | | | 73 | 30 | 43 | |
| TP-1 | 4.0 | BG | | | | | | | | 22.6 | | | | |
| TP-1 | 5.0 | BG | | | | | | | | 19.1 | | | | |
| TP-1 | 8.0 | BG | | | | | | | | 17.9 | | | | |

* Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary

** SS = Split-Spoon Sample (ASTM D 1586); UD = Undisturbed Sample (ASTM D 1587); BG = Bulk Bag Sample

Table Checked By: _____

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
Louisville, Kentucky

Project Name: FORT KNOX - QTR UPGRADE
Project Number: 50545-8-2390

SUMMARY OF LABORATORY TEST DATA

| BORING NO. | SAMPLE DEPTH, FT. | SAMPLE TYPE** | USCS CLASSIFICATION | MAX. DRY DENSITY PCF (Modified) | UNIT WEIGHT PCF | | UNCONFINED COMPRESSIVE STRENGTH PSF | % FINER NO. 200 | SPECIFIC GRAVITY | NATURAL MOISTURE CONTENT, PERCENT | ATTERBERG LIMITS | | | OPTIMUM MOISTURE (Modified) |
|------------|-------------------|---------------|---------------------|------------------------------------|-----------------|-----|-------------------------------------|-----------------|------------------|-----------------------------------|------------------|------|------|--------------------------------|
| | | | | | WET | DRY | | | | | L.L. | P.L. | P.I. | |
| TP-3 | 1.5 | BG | | | | | | | | 16.5 | | | | |
| TP-3 | 3.0 | BG | | | | | | | | 25.1 | | | | |
| TP-3 | 5.0 | BG | | | | | | | | 17.8 | | | | |
| TP-6 | 8.5 | BG | | | | | | | | 17.9 | | | | |
| TP-7 | 4.5 | BG | | | | | | | | 20.7 | | | | |
| TP-17 | 3.0 | BG | | | | | | | | 17.9 | | | | |
| TP-17 | 5.0 | BG | | | | | | | | 21.6 | | | | |
| TP-18 | 4.5 | BG | "CL-ML" | | | | | | | 15.7 | 27 | 18 | 9 | |
| TP-20 | 5.0 | BG | | | | | | | | 19.8 | | | | |
| TP-21 | 5.0 | BG | "CH" | | | | | | | 25.0 | 57 | 26 | 31 | |
| TP-24 | 5.0 | BG | | | | | | | | 18.1 | | | | |
| TP-26 | 3.0 | BG | | 115.5 | | | | | | | | | | 16.0 |
| TP-27 | 2.5 | BG | | | | | | | | 19.7 | | | | |
| TP-27 | 4.5 | BG | | | | | | | | 24.4 | | | | |
| TP-28 | 2.0 | BG | | | | | | | | 21.6 | | | | |
| TP-29 | 2.0 | BG | | | | | | | | 24.9 | | | | |
| TP-30 | 2.5 | BG | | | | | | | | 16.6 | | | | |
| TP-31 | 2.0 | BG | | | | | | | | 23.3 | | | | |

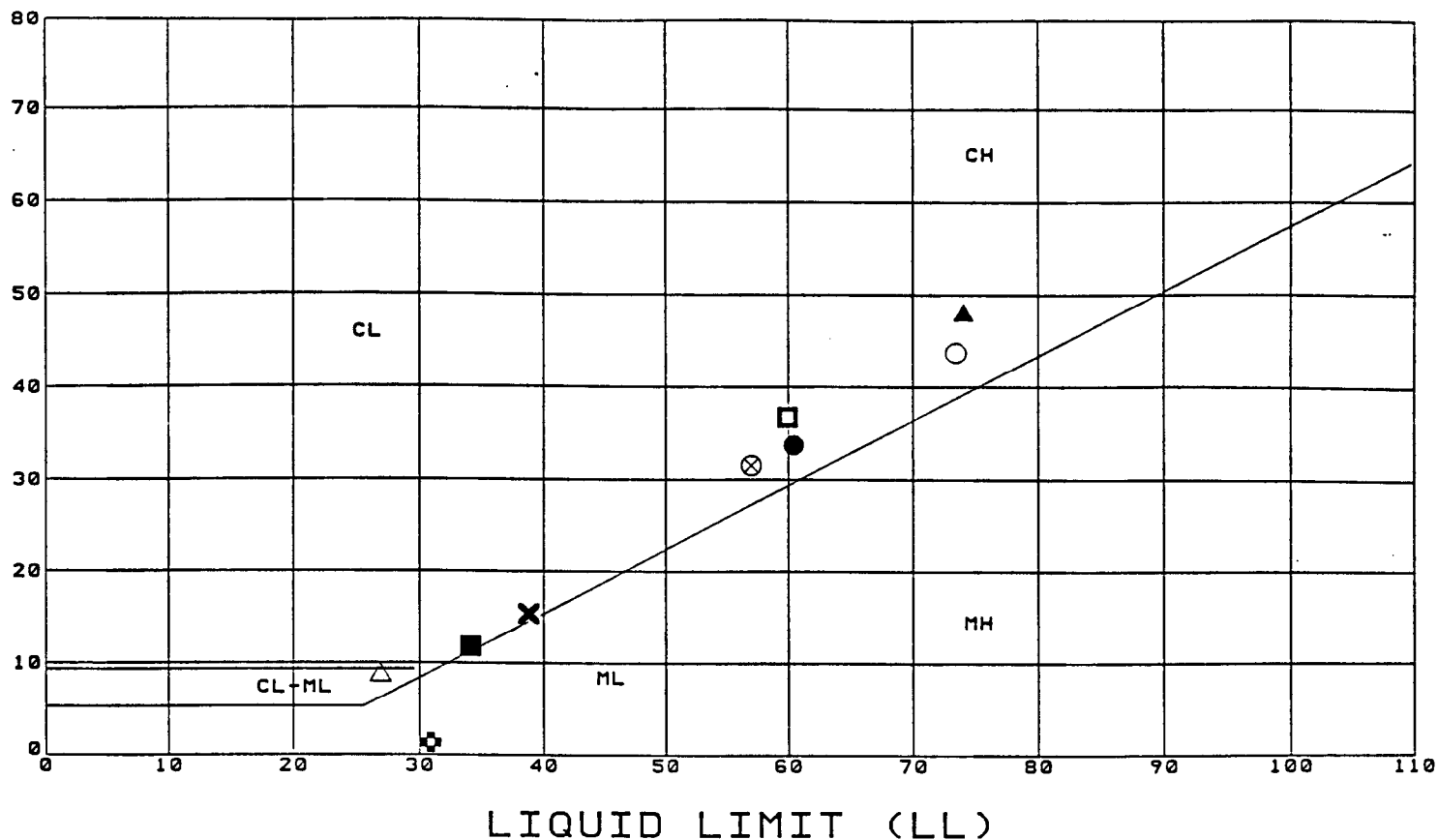
* Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary

** SS = Split-Spoon Sample (ASTM D 1586); UD = Undisturbed Sample (ASTM D 1587); BG = Bulk Bag Sample

Table Checked By:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
Louisville, Kentucky
Project Name: FORT KNOX - QTR UPGRADE
Project Number: 50545-8-2390

PLASTICITY INDEX (PI)



| LEGEND: | SOIL DESCRIPTION | LL | PL | PI | MC |
|---------|---|----|----|----|------|
| ● | B-1 1.5-3' REDDISH BROWN FAT CLAY | 60 | 27 | 34 | 19.6 |
| ▲ | B-1 4-5.5' REDDISH BROWN FAT CLAY | 74 | 26 | 48 | 26.3 |
| ■ | B-2 0-1.5' Light Brown Silty Lean CLAY | 34 | 22 | 12 | 23.8 |
| □ | B-2 4-5.5' Red Brown Fat CLAY | 60 | 23 | 37 | 22.2 |
| ⊕ | B-3 1.5-3' Light Brown SILT | 31 | 30 | 1 | 19.7 |
| × | B-5 1.5-3' MOTTLED BROWN & GRAY SILTY LEAN CLAY | 39 | 23 | 15 | 25.0 |
| ○ | B-7 9-10.5' Red Fat CLAY | 73 | 30 | 44 | |
| △ | TP-18 4-5.5' MOTTLED BROWN & GRAY SILTY LEAN CLAY | 27 | 18 | 9 | 15.7 |
| ⊗ | TP-21 5.0' REDDISH BROWN FAT CLAY | 57 | 26 | 32 | 25.0 |

June 1998

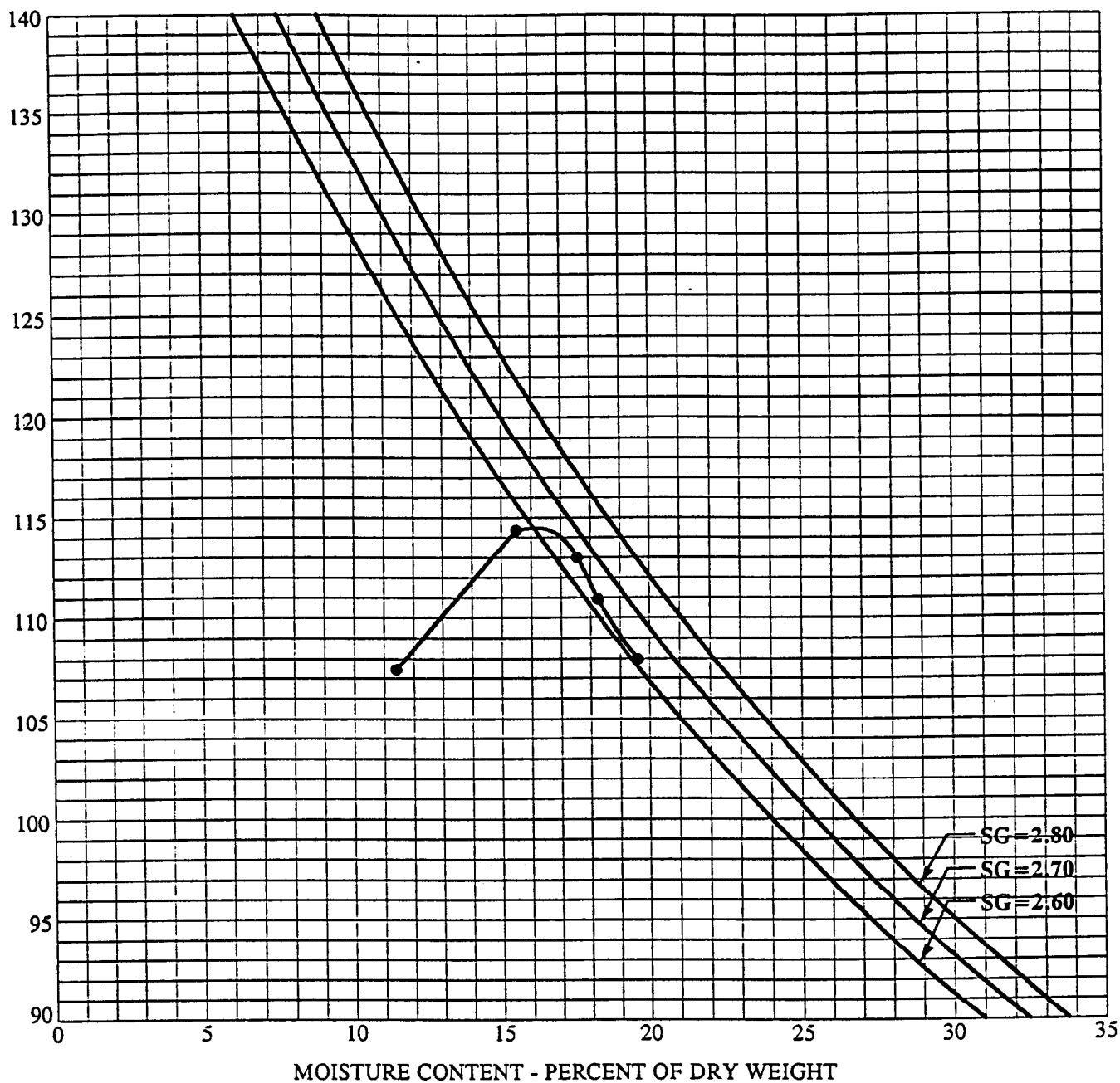
FORT KNOX -- QTR -- UPGRADE - 50545-8-2390

D
R
Y

U
N
I
T

W
E
I
G
H
T

P
C
F



June 1998

COMPACTION TEST

PROJECT FORT KNOX -- QTR -- UPGRADE
PROJECT NO. 50545-8-2390
SAMPLE NO. B-1
LOCATION Bulk Sampled
DEPTH 6.0'
SOIL DESCRIPTION Red Lean to Fat CLAY with Oxide Nodules
TEST METHOD ASTM D-1557
MAX. DENSITY 114.5
OPTIMUM MOISTURE 15.5
IN SITU MOISTURE



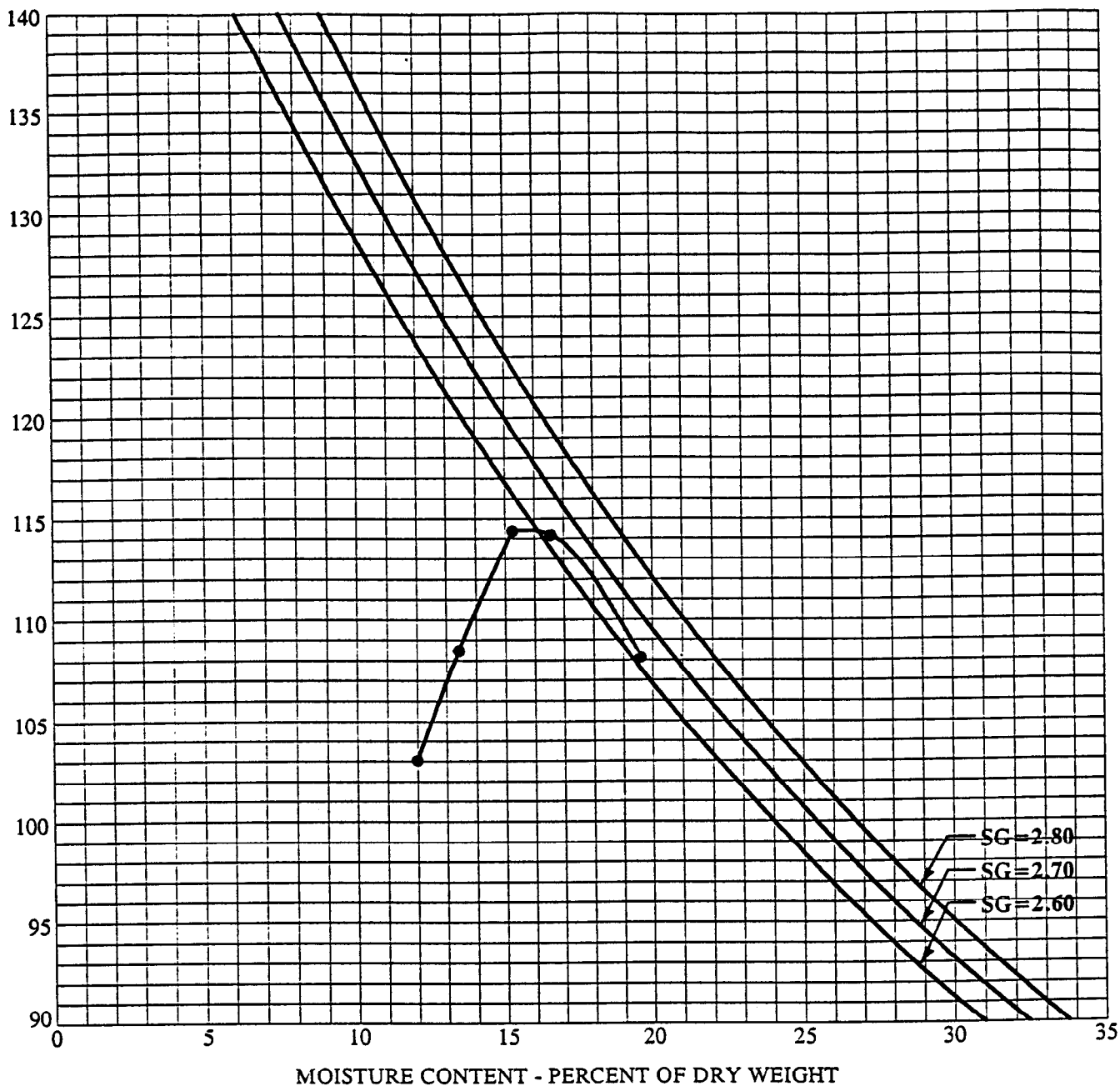
LAW ENGINEERING & ENVIRONMENTAL SERVICES

D
R
Y

U
N
I
T

W
E
I
G
H
T

P
C
F



June 1998

COMPACTION TEST

PROJECT FORT KNOX -- QTR -- UPGRADE
PROJECT NO. 50545-8-2390
SAMPLE NO. TP-26
LOCATION Bulk SAMPLED
DEPTH 3.0'
SOIL DESCRIPTION Brown Silty Lean CLAY

TEST METHOD ASTM D-1557
MAX. DENSITY 115.5
OPTIMUM MOISTURE 16.0
IN SITU MOISTURE

 LAW ENGINEERING & ENVIRONMENTAL SERVICES